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Differences in Dosing of Dexamethasone and the Effect on Post-Operative Emesis in Healthy Surgical Patients

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Abstract

Background and Review of Literature: Post-operative nausea and vomiting remains a constant threat to patients undergoing anesthesia. As such a myriad of drug compounds are utilized in the practice of anesthesia to prevent and thwart the unpleasant experience of post-operative nausea and vomiting. Although there has been agreement on the drug compounds that can successfully prevent such outcomes, little consensus has been developed for certain compounds, specifically dexamethasone.

Purpose: To determine differences in efficacy in the prevention of post-operative emesis based on dosing of dexamethasone.

Methods: A retrospective chart review was conducted on 10 healthy patients receiving > 0.1mg/kg of dexamethasone and 10 healthy patients receiving < 0.1mg/kg of dexamethasone at the induction of anesthesia. An evaluation of emesis in the post-operative period was evaluated. Microsoft Excel and Stat Crunch were used to analyze the data.

Conclusion: A comparison of the group receiving <0.1 mg/kg and > 0.1 mg/kg of dexamethasone yielded no statistical difference in the ability to prevent post-operative emesis between the two groups.

Keywords: Dexamethasone, Post-operative nausea and vomiting

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Differences in Dosing of Dexamethasone and the Effect on Post-Operative Emesis in Healthy Surgical Patients

Introduction

Post-operative nausea and vomiting is one of the most frequently encountered problems by surgical patients in the first 24 hours following surgery (Tateosian, 2018). It presents a risk for the patient in a multitude of physiologic manifestations, in addition to the discomfort it causes the patient. A number of strategies are utilized by anesthesia providers to effectively mitigate the untoward effects of post-operative nausea and vomiting. Chief among these strategies is pharmacological intervention, specifically the administration of dexamethasone, a corticosteroid. Although the effectiveness in preventing post-operative nausea and vomiting is well documented, there is a lack of consensus as to the most effective dose. Much contradictory information exists regarding the most appropriate dosage to provide the maximal effectiveness of the steroid. The purpose of this paper is to provide more data on the subject and help more fully establish a consensus on effective dosing in surgical patients.

Background

The primary purpose of anesthesia is to provide adequate levels of amnesia, analgesia, surgical anesthesia, and muscle relaxation. The techniques and spectrum of drugs used to achieve such desired levels present certain unfavorable effects for patients undergoing surgery (Nagelhout & Elisha, 2018). One such effect is the development of postoperative nausea and vomiting. Postoperative nausea and vomiting (PONV) refers to nausea and vomiting occurring within the first 24 hours following surgery. It is one of the most commonly seen adverse effects in the post anesthesia care unit (PACU) (Tateosian, 2018). Estimates suggest that up to 30% of all surgical patients experience PONV (Collaborators & West Midlands Research, 2017). Studies indicate that patients with certain risk factors experience a PONV incidence rate of 80%. PONV usually subsides over time without intervention, but the detrimental effects it presents in the immediacy of post-operation cannot be overstated. Patients experiencing PONV are at risk for intravascular depletion, electrolyte imbalances, wound dehiscence, and respiratory compromise (Tateosian, 2018). Additionally, it presents a negative experience for patients undergoing surgery. Patients have rated PONV as a more negative outcome than the post-operative pain associated with surgery (Tateosian, 2018).

The risk of PONV increases with certain patient populations, surgical influences, and other anesthetic factors. PONV incidence increases with patients of female gender, a previous history of motion sickness or PONV, those who are non-smoking, and patients less than 50 years of age. The Apfel score utilizes these factors to determine patients' risk of PONV when undergoing anesthesia for surgery. Presence of zero, one, two, three, or four risk factors represent a risk of PONV of 10, 20, 40, 60, or 80% respectively (Tateosian, 2018). Specific surgeries, such as cholecystectomies, laparoscopic procedures, and gynecological surgeries, increase the risk of PONV as well (Tateosian, 2018). Anesthetic factors play an additional role in the development of PONV. The length of anesthetic, use of opioids in a dose-dependent manner, and administration of volatile anesthetics also increase the incidence of PONV (Tateosian, 2018).

Given the detrimental effects of PONV on patients, anesthesia providers implement strategies to suppress some of these risk factors. The use of regional anesthesia decreases the need for both opioids and volatile anesthetics. Additionally, the use of total intravenous anesthetic can dramatically decrease the need for agents at significant risk for the development of PONV (Tateosian, 2018). Many pharmacological interventions are utilized as well in the form of anti-emetics. They include serotonin receptor antagonists, anticholinergics, and corticosteroids among others (Wang et al., 2000). One of the most frequently used corticosteroids is dexamethasone. It is generally used prophylactically at induction of anesthesia. Given the overwhelming glucocorticoid action of dexamethasone, it helps to prevent post-operative pain and opioid consumption. It also utilizes direct action to provide an anti-emetic effect for the patient (Tateosian, 2018). Dexamethasone also presents some untoward effects, despite its usefulness as an anti-emetic. Glucocorticoids are well established as having the ability to decrease wound healing, increasing wound infection, and increasing serum glucose (Tateosian, 2018). Single doses of dexamethasone have not shown any propensity to decrease wound healing or increase wound infection, although they have shown increases in serum glucose 6-12 hours following administration (Collaborators & West Midlands Research, 2017). As such, they are relatively contraindicated in patients with impaired serum glucose tolerance, such as those with diabetes mellitus.

Although the overwhelming support for the use of dexamethasone, as a prophylactic tool against PONV, is apparent, there is little consensus as to which dosage is the most effective at providing its desired anti-emetic effect. Many studies have provided contradictory information regarding the dosing of dexamethasone. One study conducted on women undergoing thyroidectomy, suggested that a dose of 5 mg was just as effective as a dose of 10 mg in preventing PONV (Wang et al., 2000). Another study conducted a meta-analysis on randomized control studies and found similar results indicating that a dose of 4-5 mg of dexamethasone was as effective as a dose of 8-10 mg in the reduction of PONV (De Oliveria et al., 2013). On the other hand, alternative studies have indicated higher doses of dexamethasone are more effective at preventing PONV. One such study found 8 mg of dexamethasone as the most effective dose to prevent PONV and the need for other anti-emetics in the 72 hours following surgery (Collaborators & West Midlands Research, 2017). Other studies have found that higher doses of dexamethasone lead to more opioid-sparing effect. They also indicate that higher doses decreased the variability of effectiveness within patients (De Oliveria, 2011). The lack of consensus indicates a need for further evaluation to determine the most effective dose in providing the most benefit to surgical patients.

Problem Statement

Post-operative nausea and vomiting is one of the most frequently encountered issues among surgical patients receiving anesthesia (Tateosian, 2018). Dexamethasone is a commonly used anti-emetic that has been shown to be effective in preventing PONV. There is a lack of consensus on the most effective dosage in providing the maximal benefit to surgical patients. As such, does the administration of 8 mg of dexamethasone as compared to 4 mg at the induction of anesthesia, lead to fewer incidents of post-operative emesis in healthy surgical patients?

To address the question at hand, the quality improvement approach will be in the form of chart review of surgical patients. Providing more data on the subject will hopefully lead to a more established consensus on appropriate dosing for the benefit of surgical patients in the future.

Gap Analysis

With an overall lack of consensus on appropriate dosing of dexamethasone at clinical sites, providing concrete evidence as to the minimum effective dosing would be beneficial in a multitude of ways. One would be an ability to provide a protocol for providers to follow and eliminate uncertainty. Another benefit would be potential cost savings. By identifying an effective dose for surgical patients, it could allow for more specific ordering and even decrease orders for dexamethasone. Finally, by providing evidence for an effective dose, it could alleviate PONV and lead to more efficient turnover in the PACU, saving money and providing a better experience for patients.

Literature Review

Search Methodology

To find articles relating to the problem statement, a number of databases were used. The databases most useful in finding articles of interest were PubMed and Google Scholar. The articles used in the review of literature were mostly accessed through PubMed. Some articles were identified on Google Scholar but were hidden behind a purchase requirement. In such instances, the articles were searched on PubMed and were made available by Marian University. The terms utilized in the search included dexamethasone, PONV, dosing, minimum effective dose, 4mg, and 8mg. Boolean phrases were also employed. In general, dexamethasone was combined individually with PONV, dosing, minimum effective dose, 4mg, and 8mg, using “AND”. In addition, dexamethasone was combined with 4mg and 8mg using “AND” between each term. The search terms resulted in 8,673 articles.

Inclusion and exclusion criteria were used to hone the search into more appropriate terms. One criterion that was used was the year the article was published. Articles that pre-dated 2015 were not used in the review of literature; therefore, articles from 2014 and before were excluded from the review with a few exceptions. Studies conducted by De Oliveria et al. (2011), De Oliveria et al. (2013), and Wang et al. (2000) were included due to their impact on the subject of dexamethasone and PONV. They were pivotal articles that are still cited to this day. Additionally, only articles that were published in peer-reviewed journals were included in the review. The specialized nature of the subject led to a plethora of reviewed articles. Articles relating to the use of dexamethasone in pediatric surgical cases were excluded as this paper is focused on its impact on adults. Studies evaluating combinations of dexamethasone with other antiemetic drugs in which the dose of dexamethasone was identical in both study groups were also excluded due to an inability to extract any useful data regarding dexamethasone and its individual ability to prevent PONV. Additionally, articles evaluating effects that did not include PONV were not utilized, as they did not comment on the emphasis of this paper. Finally, articles citing administration of dexamethasone in forms other than intravenous were omitted, as the focus of this paper is intravenous dosing. From the 8,673 articles searched, evaluated, and read, fourteen met criteria to be included in the review of literature.

Consensus on the Use of Dexamethasone

The use of dexamethasone as an anti-emetic and anti-inflammatory agent in the world of surgery has been well documented. However, upon thorough examination of the existing literature on the topic, little consensus exists as to the minimum dose needed to be effective to decrease incidence of PONV and minimize post-operative pain. In fact, much contradictory evidence exists in regards to effective dosing of dexamethasone.

Evidence to Support Minimal Dosing

Several studies have evaluated lower doses of dexamethasone and its effectiveness in comparison to efficacy of higher doses of the steroid. DeOliveria et al. (2013) evaluated doses of dexamethasone of 4-5 mg and doses of 8-10 mg. They performed a quantitative systematic review of nearly 90 studies relating to PONV and dosing with dexamethasone. Their review of nearly 7,000 surgical patients suggested similar efficacy between 4-5 mg and 8-10 mg of dexamethasone in the prevention of PONV. Wang et al. (2000) had similar findings in their dose-ranging study. The authors compared five different doses of dexamethasone administered to female patients undergoing thyroidectomy. Two doses were found to be effective at minimizing PONV, both the 5 mg and 10 mg doses. Interestingly enough, the doses were found to be statistically similar in their prevention of PONV. A similar study conducted by Gupta et al. (2018), echoed similar sentiments to the previously mentioned studies. Gupta et al. (2018) evaluated dose impact of dexamethasone on PONV in patients undergoing laparoscopic cholecystectomy. Similarly they placed the subjects in their study into five different dosing groups. They found that the minimum dose of dexamethasone to prevent vomiting was 2 mg, while the minimum dose to prevent nausea was 4 mg. Firdaus et al. (2016) also evaluated the impact of dexamethasone on patients undergoing laparoscopic procedures. Their results were similar to Gupta et al. (2018) but they found that a hypnotic dose of propofol, 0.5 mg/kg, in conjunction with 4 mg of dexamethasone was equally as effective as 8 mg of dexamethasone in the prevention of PONV. Arumumgam et al. (2020) recently re-emphasized 4 mg of dexamethasone being an effective dose in the prevention of PONV in their study with patients undergoing knee and hip arthroplasty. The results of these studies suggest that doses of 4 mg of dexamethasone are sufficient in the inhibition of PONV in surgical patients. While providing adequate anti-emetic qualities, the detrimental effects of corticosteroids are reduced by providing the minimum effective dose.

Argument for High-Dose Dexamethasone

While a case has been made for 4 mg of dexamethasone being an effective anti-emetic, much research suggests higher efficacy for doses above 8 mg. A research study conducted by West Midlands Research (2017) in the United Kingdom evaluated the use of 8 mg of dexamethasone in patients undergoing bowel surgery. They found a significant reduction in the need for rescue anti-emetics and incidences of postoperative vomiting. Yue et al. (2017) led a study with similar results in the evaluation of high-dose versus low-dose dexamethasone in patients electing for total knee or hip arthroplasty. High-dose dexamethasone was considered greater than 0.1 mg/kg and low dose was anything less than 0.1 mg/kg. The patients receiving high-dose dexamethasone had lower incidence of PONV than those receiving the low-dose. A study conducted by Sekhavat et al. (2015) also found 8 mg of dexamethasone to be an effective dose in the prevention of PONV in women undergoing abdominal hysterectomy. Both Cortes-Flores et al. (2018) and Tarantino et al. (2015) found 8 mg of dexamethasone to be the minimal effective dose in the prevention of PONV, in their studies regarding breast surgery and thyroidectomy, respectively. Finally, Yamanaga et al. (2017) evaluated dose-dependent efficacy of dexamethasone in patients who underwent laparoscopic donor nephrectomy. A comparison was drawn between 4-6 mg and 8-14 mg of dexamethasone. Patients receiving doses of 8-14 mg were found to have decreased bouts of PONV in comparison to the group receiving lower doses. These studies directly contradict the previously mentioned studies indicating 4 mg of dexamethasone being a minimum effective dose in the prevention of PONV.

Additional Benefits of High-dose Dexamethasone

While higher doses of dexamethasone have been shown to be effective in the prevention of PONV, the higher doses have also been shown to be effective in other ways that may indirectly lead to lower levels of PONV. Both De Oliveria et al. (2011) and Mihara et al. (2016), conducted studies that indicated that doses of dexamethasone greater than 0.1 mg/kg lead to better pain control and minimized consumption of opioids in the immediate postoperative period. These results were further endorsed by Yamanaga (2017), which indicated that doses of 8-14 mg of dexamethasone were not only effective in reducing PONV but decreased opioid consumption as well. Interestingly, Kleif et al. (2017) did not find 8 mg of dexamethasone to be an effective dose in the prevention of PONV in patients with suspected appendicitis undergoing laparoscopic procedures. However, they did find that dexamethasone did decrease pain, fatigue, and opioid consumption in the postoperative period. Cortes-Flores et al. (2018) found 8 mg of dexamethasone to be effective in the prevention of PONV as well as postoperative pain and analgesic requirements in their study with women undergoing breast surgery. Opioids are well known as emesis inducing agents. In fact, the Apfel scoring tool indicates dosing of opioids throughout a surgical case increases the chance of PONV by nearly 20%. Given the tremendous ability of higher doses of dexamethasone to decrease the need for opioids in the immediate postoperative period, it stands to reason that this indirectly reduces the incidence of PONV by extension as well.

Theoretical Framework

PONV is considered by surgical patients to be one of the most unpleasant symptoms experienced in the postoperative period. It is often cited as a worse symptom than the pain associated with the procedure (Tateosian et al., 2018). As such, the Theory of Unpleasant Symptoms, a middle range nursing theory, serves as a useful tool in the explanation of the question presented. The Theory of Unpleasant Symptoms is made up of three major concepts. They include symptoms, influencing factors, and performance outcomes (Lenz & Pugh, 2018).

Symptoms are the impetus for the theory and, as a result, are the central figure. Within the theory, symptoms are defined as experienced changes in normal functionality as perceived by patients. The theory asserts that symptoms can occur singularly or in succession of one another (Lenz & Pugh, 2018). As it relates to PONV seen in surgical patients, post-operative nausea may proceed vomiting, occur in conjunction with one another, or either may exist in isolation. Symptoms also manifest in varying facets. They include the severity, degree of distress, timing, and quality associated with the symptoms (Lenz & Pugh, 2018). In PONV the severity relates to the intensity of the symptom and may lead to vomiting, the degree of distress may exhibit differing levels of unpleasantness among patients, the timing is limited to the first 24 hours postoperatively, and the quality is specific to the experience of the patient.

Three individual factors were identified as having influence on the symptoms experienced by patients in the theory. One such influencing factor named is the physiologic factor. This relates to the biologic makeup of the patient, the relationship to treatment undergone, and the genetic uniqueness of the patient (Lenz & Pugh, 2018). Another factor listed is the psychological factor. This refers to the mood of the patient prior to the experience of the symptoms and how their state of mind can determine their symptomology. Psychological factors can also impact how the patient responds to the symptoms and have an affect on the degree of distress experienced by the patient (Lenz & Pugh, 2018). The final factor is identified as the situational factor. This relates to the background of the patient, such as their socioeconomic status, access to healthcare, familial support. The physical environment of the patient can also aid in the experience of symptoms, such as the altitude, temperature, or noise level of the surrounding setting (Lenz & Pugh, 2018).

Performance outcomes are the final key concept within the Theory of Unpleasant Symptoms. This references the experience of symptoms by patients and their influence on the ability of the patient to function at a normal level. A patient experiencing symptoms may impact their ability to sleep, interact with others, or perform self-care or care for others (Lenz & Pugh, 2018).

The three major concepts have a complex interplay among one another as evidenced by the graphic illustrated in Appendix II. The influencing factors have an impact on the symptoms experienced by the patient. The symptoms experienced by the patient have a tremendous influence on the patient's ability to function at a normal level. The patient's ability to function at a normal level affects their psychological factors, which can have a dramatic influence on physiologic factors. Alterations in some of the influencing factors and performance can affect the level of distress or quality of symptoms experienced by the patient (Lenz & Pugh, 2018). Quite clearly there is some level of influence or feedback of each concept on one another.

The Theory of Unpleasant Symptoms provides a theoretical framework to direct the question presented. The aim of this paper is to determine differences in efficacy between 4 mg and 8 mg of dexamethasone in the prevention of postoperative vomiting in the first 24 hours following surgery. The dosage differences will have different physiologic impact on the patient. The differences in physiologic response can lead to different experience of symptoms, notably postoperative vomiting in this situation. The presence or absence of postoperative vomiting will have a tremendous impact on the outcome for the patient in the form of enhanced recovery and return to baseline functionality. By examining the differences in physiologic response to the two doses of dexamethasone, it will be determined if one is more effective at preventing postoperative vomiting and enhancing patient recovery by the patient.

Goals, Objectives, and Expected Outcomes

The ultimate goal of this paper is to evaluate the differences, if any, in efficacy between <0.1 mg/kg and > 0.1 mg/kg of dexamethasone in the prevention of incidences of vomiting in surgical patients in the first 24 hours following procedure. Anesthesia providers will carry out the administration of the varying doses of dexamethasone, while registered nurses working in a post-anesthesia capacity will conduct the documentation of vomitus. The expected outcome should refine the consensus on effective dosing of dexamethasone in the operative period for surgical patients.

Project Design

The project is intended to be a quality improvement project in the form of an evaluation of practice intervention. Healthy surgical patients receiving either < 0.1 mg/kg or > 0.1 mg/kg of dexamethasone during the operative period will be evaluated as individual groups. The remainder of the administered anesthetic between the two groups should be as similar to one another as possible, in the form of dosing of general anesthesia compounds and drugs utilized in the maintenance of anesthesia. Incidence of PONV and vomitus will be documented and recorded in the patient's electronic health record. Utilizing the health record, a quantitative evaluation will be made regarding the different doses of dexamethasone and incidence of postoperative vomitus.

Project Site and Population

Project site was a full-service regional hospital in the Midwestern United States that offers full-time emergency services and a Level III trauma center. The hospital is full-service, offering full-time emergency services and a Level III trauma center. They offer a wide array of surgical procedures including general, gastrointestinal, orthopedic, gynecological, dental, and ear, nose, and throat surgeries. The facility employs numerous full-time anesthesiologists and three certified registered nurse anesthetists. One anesthesiologist oversees the anesthetics employed by two to three nurse anesthetists at staggered times. The hospital also has a two-phase post anesthesia care unit staffed by registered nurses. Phase 1 is set-aside for patients undergoing general anesthesia, while Phase 2 is reserved for patients undergoing monitored anesthesia care.

The population being evaluated in this study was healthy surgical patients undergoing general anesthetics at St Francis Lafayette East. Included were adult patients over the age of 18 years undergoing surgical procedures and a designation of ASA 1 or ASA 2 from the administering anesthesiologist as documented in the health record. The patient will need to have undergone a general anesthetic in some form of a surgical procedure and received either < 0.1 mg/kg or > 0.1 mg/kg of dexamethasone within 15 minutes of the induction of anesthesia. Additional criteria will include the reception of induction medications dosed within the following ranges: fentanyl (0.5-1 mcg/kg), lidocaine (0.5-1 mg/kg), propofol (1.5-2.5 mg/kg), hydromorphone (0.1 mg/kg), and rocuronium (0.6-1.2 mg/kg). Maintenance will be in the form of volatile anesthetic by means of Sevoflurane administration of 0.5-1.3 minimum alveolar concentration on 1-2 liters of fresh gas flow. The patient will also receive 4 mg of ondansetron.

Exclusion criteria will include patients under the age of 18 years, patients with an ASA 3 or ASA 4 designation, patients receiving an anesthetic other than a general, patients that do not receive specified doses of dexamethasone, induction medications, maintenance medications, or ondansetron. Patients undergoing laparoscopic procedures will also be excluded as this surgical technique can amplify PONV.

The study was conducted by utilizing a retrospective analysis of data in the form of chart review. Patients meeting inclusion criteria and having undergone surgical procedures within the last year will be selected at random. In the electronic health record review, the incidence of vomitus was evaluated in individuals receiving < 0.1 mg/kg of dexamethasone and > 0.1 mg/kg of dexamethasone. Once a sufficient population of both groups of individuals was established, a statistical analysis of the data was conducted to determine if there was a significant difference between the two groups and the prevention of emesis in the immediate postoperative period.

Measurement Instruments

Incidence of vomitus by surgical patients was conducted by chart review and electronic evaluation in the post anesthesia care unit following the surgical procedure. The measurement of vomitus was a straightforward and strong method of evaluating the outcome of interest. However, the measurement was dependent on the documentation of the incident by the nursing staff in the postoperative period.

Data Collection

Anesthesia care providers conducted documentation of medications administered in the preoperative and intraoperative period of the procedure. Registered nurses working in a post anesthesia capacity conducted documentation of postoperative PONV, incidence of vomitus, and postoperative medications. This documentation should be conducted regardless of ongoing investigation, as it is required by hospital and state policy. The incidence of vomitus was tallied for each group using retrospective chart review and determined to be statistically significant or not by means of statistical analysis tools. The data was collected from a two-week period from October 25, 2021 to November 5, 2021.

Ethical Considerations/Protection of Human Subjects

Both the Marian Internal Review Board and Franciscan Internal Review board approval were obtained prior to initiating the project. Additionally, all participants were protected by the Health Insurance Portability and Accountability Act of 1996, which ensures the health information of individuals, is kept private (Office for Civil Rights, 2020). The chart reviews of the patients included in the study were conducted by the DNP student and done in a hospital setting and posed no more risk of breach than the day of their original surgical procedure. Any patient identifiers were removed and patients were anonymously placed into groups according to their dose of dexamethasone received. All access to patient records by the co-investigators is password protected.

Data Analysis

Data analysis was conducted using Stat Crunch software. The Chi-Square test was utilized to determine statistical significance between the two groups, with a statistical significance of $P < 0.05$.

Results

Participants

Twenty subjects undergoing general anesthesia at Franciscan Lafayette East were chosen at random from this time period and placed into groups receiving < 0.1 mg/kg and > 0.1 mg/kg of dexamethasone, granted they met inclusion criteria. Ten individuals were found to meet criteria for each group. The group receiving < 0.1 mg/kg of dexamethasone included eight males and two females with an average age of 61.3 years. The group receiving > 0.1 mg/kg of dexamethasone included five males and five females with an average age of 58.9 years (see Appendix III).

Post-Operative Emesis

There was not a statistically significant difference in the dosing of dexamethasone and its resulting effect on postoperative emesis. The Chi Square test resulted in a P value of 0.555950672, indicating a lack of statistical difference between the two groups in this study.

Discussion

The aim of this study was to determine whether a difference in dosing of dexamethasone led to differences in post-operative emesis in healthy patients undergoing general anesthesia. Two different groups were assessed in this study, one group receiving high-dose steroid or > 0.1 mg/kg of dexamethasone and one group receiving low-dose steroid or <0.1 mg/kg of dexamethasone. There was not a statistical difference in the two groups and their ability to prevent post-operative emesis. The results echoed studies conducted by DeOliveria (2013), Wang et al. (2000), Gupta et al. (2018), Arumumgam et al. (2020), and Firdaus et al. (2016), which all suggested that lower dosing of dexamethasone led to similar efficacy as higher doses in the prevention of post-operative nausea and vomiting.

There were several limitations to this study given its retrospective nature. Much larger multi-site, randomized controlled studies would be needed to extract any meaningful data regarding dexamethasone and its minimum effective dose. There could certainly be provider bias with dosing of dexamethasone when evaluating the results from just one clinical site with this study. Additionally, there was significant emphasis placed on chart review in this study and a dependence on accurate documentation of events experienced by the patients. It is possible that some of these patients experienced vomiting that was not accurately recorded or occurred after the patient had left the PACU.

Conclusion

This study suggests that lower doses of dexamethasone present similar levels of efficacy in the prevention of postoperative nausea and vomiting. Given the level of importance of preventing post-operative nausea and vomiting to patients, studies like this should help to identify the most efficacious dose of dexamethasone, while preventing some of the untoward effects seen with high doses of steroids (Tateosian, 2018). Further multi-site, randomized controlled studies will be needed to clarify the most appropriate dosing of dexamethasone in surgical patients.

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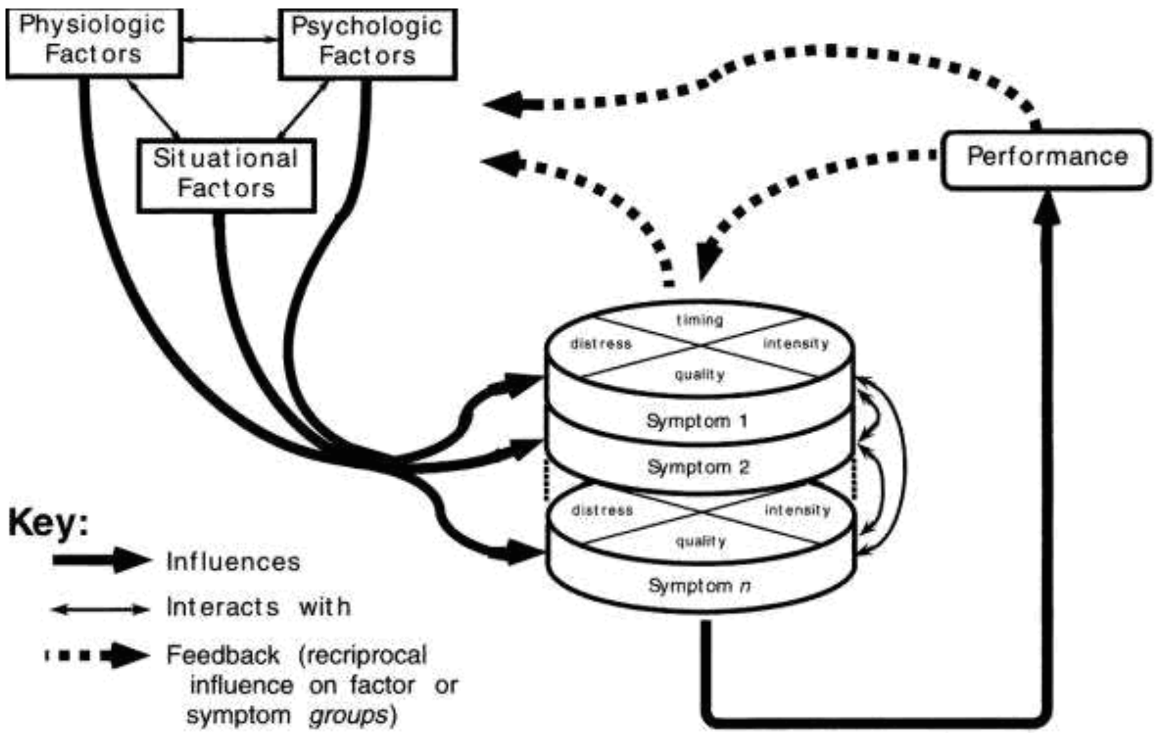
Appendix I

Literature Review Matrix					
Reference in APA format	**Level of Evidence**	**Variables**	**Sample**	**Instruments**	**Results**
Collaborators, D.T. and C. West Midlands Research. (2017). Dexamethasone versus standard treatment for postoperative nausea and vomiting in gastrointestinal surgery: Randomized controlled trial. *British Medical Journal, 357*, 1-10. https://dx.doi.org/10.1136/bmj.j1455	Level 1	Vomiting within 24 hours of surgery, vomiting within 72-120 hours, fatigue and quality of life at 120 hours, time to return to fluid and food intake, length of hospital stay, and adverse events	N=1350, 674 receiving dexamethasone in additon and 676 receiving standard of care undergoing elective open or laparocopic bowel surgery	Reported incidents by either patient or clinician and timing of incidents	Vomiting within 24 hours was seen in 172 (25.5%) receiving dexamethasone and 223 (33.0%) of participants receiving standard of care. Additional antiemetics were given to 39.3% of participants receiving dexamethasone and 51.9% receving standard of care.
De Oliveria, G. S., Almeida, M. D., Benzon, H. T., McCarthy, R. J. (2011). Perioperative single dose systemic dexamethasone for post-operative pain: A meta-analysis of randomized controlled trials. *Anesthesiology, 115*(3), 575-588. Doi: 10.1097/ALN.0b013e31822a24c2	Level 1	Pain at 0-4 hr post-operatively, 24 hour post-operatively, and cumulative opioid consumption in postoperative period	N=2751, surgical patients receiving dexamethasone, broken into 3 dosage groups: low (less than 0.1 mg/kg), intermediate (0.11-0.2 mg/kg), and high (>=0.21 mg/kg) doses	Visual analog or numeric rating scale pain scores and timing of pain	Reduced postoperative pain and opioid consumption was seen in patients receiving doses of dexamethasone > 0.1 mg/kg
De Oliveria, G. S., Castro-Alves, L. J., Ahmad, Shireen, Kendall, M., & McCarthy, R. J. (2013). Dexamethasone to prevent postoperative nausea and vomiting: An updated meta-analysis of randomized controlled trials. *Anesthesia & Analgesia, 116*(1), 58-74. Doi: 10.1213/ANE.0b013e31826f0a0a	Level 1	Incidence of PONV in first 24 hours following surgery	N=6696, surgical patients receiving 4-5 mg of dexamethasone and patients receiving 8-10 mg of dexamethasone	Reported incidents of PONV	Similar clinical effects are seen with doses 4-5 mg and 8-10 mg of dexamethasone in regards to the reduction of PONV
Gupta, R., Srivastava, S., Dhiraaj, S., & Chovatiya, P. P. (2018). Minimum effective dose of dexamethasone in combination with midazolam as prophylaxis against postoperative nausea and vomiting after lapraroscopic cholecystectomy. *Anesthesia Essays adn Researches, 12*(2), 396-401. Doi: 10.4103/aer.AER_19_18	Level 1	Incidence of nausea, vomiting, severity of nausea, the use of rescue anti-emetic, and postoperative pain	N=155, surgical patients undergoing laparoscopic cholecystectomy, 31 participants were randomly assigned to one of five groups receiving various doses of dexamethasone (0 mg, 1 mg, 2 mg, 4 mg, and 8 mg)	Visual analog scale to determine severity of vomiting and pain, record of vomiting incidents	The minimum effective for prevention of nausea was 4 mg of dexamethasone and for prevention of vomiting was 2 mg
Wang, J. J., Ho, S. T., Lee, S. C., Liu, Y. C., & Ho, C.M. (2000). The use of dexamethasone for preventing postoperative nausea and vomiting in females, undergoing thyroidectomy: A dose-ranging study. *Anesthesia & Analgesia, 91*(6), 1404-1407. Doi: 10.1097/00000539-200012000-00019	Level 1	PONV evaluated by incidences of nausea and vomiting, episodes of vomiting, and use of rescue anti-emetics	N=225 women undergoing thyroidectomy, 45 participants randomly assigned to one of five groups receiving various doses of dexamethasone (0 mg, 1.25 mg, 2.5 mg, 5 mg, and 10 mg)	Evaluation by nurse anesthetists every 4 hours and patient complaint	Dexamethasone doses of 5 mg and 10 mg provided equal effectiveness in preventing PONV in women undergoing thyroidectomy
Sekhavat, L., Davar, R., & Behdad, S. (2015). Efficacy of prophylactic dexamethasone in prevention of nausea and vomiting. *Journal of Epidemiology and Global Health, 5*(2), 175-179. https://doi.org/10.1016/j.jegh.2014.07.004	Level 1	Incidences of nausea, vomiting, and need for rescue anti-emetic in first 24 hours following surgery	N=100, women undergoing total abdominal hysterectomy, with 50 receiving 8mg of dexamethasone and 50 receiving saline	Patients report of nausea on a linear scale of 0-10 and record of patient vomiting or retching	Dexamethasone dose of 8 mg was shown to be effective in reducing PONV in women undergoing abdominal hysterectomy
Yue, C., Wei, R., & Liu, Y. (2017). Perioperative systemic steroid for rapid recovery in total knee and hip arthroplasty: A systematic review and meta-analysis of randomized trials. *Journal of Orthopaedic Surgery and Research, 12*(1), 100-111. Doi: 10.1186/s13018-017-0601-4	Level 1	Incidences of PONV and pain the first 24 hours following surgery	N=774, surgical patients undergoing either total hip or knee arthroplasty, with individuals either receiving high-dose dexamethasone (>0.1mg/kg) or low-dose dexamethasone (<0.1mg/kg)	Patient report of nausea and vomiting and report of pain on a linear scale	High-dose dexamethasone showed lower incidence of PONV and pain in the first 24 hours following surgery
Mihara, T., Ishii, R., Ka, K., & Goto, T. (2016). Effect of steroids on quality of recovery and adverse events after general anesthesia: Meta-analysis and trial sequential analysis of randomized clinical trials. *PLoS ONE, 11*(9), 1-14. Doi: 10.1371/journal.pone.0162961	Level 1	Quality of Recovery following surgery, using 5 criteria which include physical comfort, emotional state, physical independence, psychological support, and pain	N=301, patients undergoing general anesthesia	QoR-40 questionnaire results	Dexamethasone doses of 0.1 mg/kg lead to improved scores of physicial independence and pain control compared to those receving dexamethasone 0.05 mg/kg
Yamanaga, S., Posselt, A. M., Freiese, C. E., Kobayashi, T., Tavakol, M., & Kang, S. (2017). A single perioperative injection of dexamethasone decreases nausea, vomiting, and pain after laparoscopic donor nephrectomy. *Journal of Transplantation, 2017,* 1-8. https://doi.org/10.1155/2017/3518103	Level 1	Incidence of PONV and pain in the first 24 hours following laparoscopic donor nephrectomy	N=281, patients undergoing laparoscopic donor nephrectomy, with 70 receiving 4-6 mg of dexamethasone, 100 receiving 8-14 mg of dexamethasone, and 111 receiving none at all	Use of opioids and rescue anti-emetics	Patients receiving 8-14 mg of dexamethasone had decreased and opioid consumption in comparison to the patients who received lower doses or who did not receive dexamethasone
Arumugam, S., Woolley, K., Smith, R. A., Vellanky, S., Cremins, M. S., & Dulipsingh, L. (2020). Comparison of dexamethasone 4mg vs 8mg doses in total joint arthroplast patients: A retrospective analysis. *Cureus, 12*(9): e10295. doi:10.7759/cureus.10295	Level 1	Incidence of PONV, PACU time, and length of stay	N=715, patients undergoing total hip or knee arthroplasty, with 148 receiving 4mg of dexamethasone and 567 receiving 8mg of dexamethasone	Reported incidence of PONV	Dexamethasone doses of 4mg and 8mg were equally effective in preventing PONV
Firdaus, K., Adnan, D., Muhammad, M., Rahman, R. A., Kamaruzaman, E., Manap, N. A., Vera, S. R., & Zain, J. (2016). Dexamethasone 8 mg versus dexemethasone 4 mg with propofol 0.5 mg/kg for the prevention of postoperative nausea and vomiting after laparoscopic gynaecology procedure. *International Medical Journal, 23*(1), 43-46.	Level 1	Incidence of PONV	N=100, women undergoing laparoscopic gynaecology surgery, 50 receiving 8 mg of dexamethasone, 50 receiving 4 mg of dexamethasone and 0.5 mg/kg of propofol	Reported incidence of PONV and use of rescue anti-emetics	The two groups were similar in their prevention of PONV in the surgical patients
Kleif, J., Kirkegaard, A., Vilandt, J., & Gogenur, I. (2017). Randomized clinical trial of preoperative dexamethsone on postoperative nausea and vomiting after laparoscopy for suspected appendicitis. *British Journal of Surgery, 104*(4), 384-392. https://doi-org.forward.marian.edu/10.1002/bjs.10418	Level 1	Incidence of PONV, including pain, fatigue, sleep, opioid consumption, use of antiemetics, quality of recovery and duration of convalesence	N=116, patients undergoing surgery for suspected appendicitis, with 57 receiving 8 mg of dexamethasone and 59 in the placebo group	Postoperative questionnaire	Patients receiving 8 mg of dexamethasone did see reduced incidence of PONV but can reduce pain, fatigue, and opioid consumption
Tarantino, I., Warschkow, R., Beutner, U., Kolb, W., Luthi, A., Luthi, C., Schmied, B. M., Clerici, T. (2015). Efficacy of a single preoperative dexamethasone dose to prevent nausea and vomiting after throidectomy (the tPONV study): A randomized, double-blind, placebo-controlled clinical trial. *Annals of Surgery, 262*(6), 934-940. DOI: 10.1097/SLA.0000000000001112	Level 1	Incidence of PONV at 4, 8, 16, 24, 32, and 48 hours after surgery	N=70, patients undergoing thyroidectomy, 35 receiving saline and 35 receiving 8 mg of dexamethasone	Assessment by nursing staff in the postoperative period	Patients receiving 8 mg of dexamethasone had half the incidence of PONV as the control group
Cortes-Flores, A. O., Jimenez-Tornero, J., Morgan-Villela, G., Delgado-Gomez, M., Zuloaga-Fernandez, J., Garcia-Renteria, J., Rendon-Felix, J., Fuentes-Orozco, C., Amezcua, M., Ambriz-Gonzales, G., Alvarez-Villasenor, A. S., Urias-Valdez, D., Chavez-Tostado, M., Contreras-Hernandez, G. I., Gonzales-Ojeda, A. (2018). Effects of preoperative dexamethasone on postoperative pain, nausea, vomiting and respiratory function in women undergoing conservative breast surgery for cancer: Results of a controlled clinical trial. *European Journal of Cancer Care, 27*(1), e12686. https://doi-org.forward.marian.edu/10.1111/ecc.12686	Level 1	Incidence of PONV and pain at 1 hour before surgery and 1, 6, 12, and 24 hours after surgery	N=80, women patients undergoing conservative surgery for breast cancer, with 40 receiving placebo via saline and 40 receiving 8 mg of dexamethasone	Reported incidence of PONV, pain, and measurement of postoperative respiratory function utilizing spirometry	8 mg of dexamethasone lead to significant lower incidences of PONV, pain, and improved respiratory parameters, and reduced need for additional postoperative analgesic and antiemetic drugs

Appendix II



Note. From *Theory of Unpleasant Symptoms* [Picture] by Lenz & Pugh, 2018, *Middle Range Theory of Nursing*

Appendix III

Procedure	ASA	Age	Sex	<.1mg/kg	>.1 mg/kg	Emesis in Post-Op?
ORIF Forearm	1	24	M	x		N
ORIF Hip	2	90	M	x		N
ORIF Humerus	2	78	F	x		N
Lumbar Fusion	2	78	F		x	N
Diskectomy	2	57	M		x	N
ORIF Wrist	2	57	M	x		N
Shoulder Arthoscopy	2	56	M		x	N
Shoulder Arthoscopy	2	36	M		x	N
Shoulder Arthoscopy	2	55	M		x	N
Total Hip Replacement	2	66	F		x	N
Excision Inguinal Lymph Node	2	56	M	x		N
Lumbar Fusion	2	70	F		x	N
Diskectomy	2	40	M		x	N
Knee Replacement	2	71	F		x	N
Shoulder Arthroscopy	2	85	F	x		N
Right Thyroid Lobectomy	2	62	M	x		N
Left Thyroidectomy	2	41	M	x		N
Endoscopic Antrostomy	2	79	M	x		N
Rectal Exam	2	41	M	x		N
Diskectomy	2	60	F		x	N
				Chi Square Result		
				P = 0.55950672		