PCRC Proposal Cover Sheet

Title: National Practice Patterns for Postoperative Nausea and Vomiting Prophylaxis

Principle Investigator: Jonathan P. Wanderer, MD, MPhil

Co-Investigators: Jesse M. Ehrenfeld, MD, MPH; Matthew S. Shotwell, Ph. D; Nathan L. Pace, MD, MStat and others that are interested

Approved by Mentor: Jesse M. Ehrenfeld, MD, MPH

Type of Study: Retrospective

Hypothesis: The variability in the number of perioperatively administered postoperative nausea and vomiting (PONV) prophylactic medications is predominately attributable to PONV risk factors.

Number of Patients/Participants: TBD

Power Analysis: Not applicable

Proposed statistical test/analysis: See methods

Resources (Brief summary of resources for data collection, personnel, financial):

Resources for Data Collection: Michaelene Johnson will be abstracting data from the MPOG database.

Personnel: Jonathan P. Wanderer, MD, MPhil (anesthesia); Jesse M. Ehrenfeld, MD, MPH (anesthesia); Matthew S. Shotwell, Ph. D (biostatistics); Nathan L. Pace, MD, MStat (biostatistics, anesthesia)

Financial: Department of Anesthesiology, Vanderbilt University

Introduction

What is the significance of the clinical problem being addressed?

Postoperative nausea and vomiting (PONV) is a one of the biggest concerns for patients undergoing outpatient and inpatient surgery.[1,2] More than 71 million surgeries are performed each year in the United States and up to 20-30% of patients will be afflicted by PONV if left untreated.[3] PONV is unpleasant for patients and can lead to unplanned hospital admissions and increased PACU length of stay, both of which increase health care costs.[4,5] The Society for Ambulatory Anesthesia released updated guidelines for PONV management in 2008 which recommend prophylactic interventions that are proportionate to risk.[6] There are few published data evaluating adherence to these guidelines. This study intends to determine the relationship between the number of PONV prophylactic medications administered, the site of care, the type of anesthesia provider and PONV risk factors. We hypothesize that the variability in the number of perioperatively administered postoperative nausea and vomiting (PONV) prophylactic medications is predominately attributable to PONV risk factors.

What current gaps exist in the understanding of this problem?

Despite the promulgation of national practice guidelines for the management of PONV, practice variations have been demonstrated to exist between anesthesia providers.[7] A number of efforts have been made in reducing these practice variations and decreasing the incidence of PONV. One of the earliest described interventions gave provider-specific feedback in the form of email, which was successful in reducing variation.[8] In a separate effort, a pop-up was created within an anesthesia information management system.[9] This intervention increased adherence to practice guidelines, but only while the pop-up was active. Another strategy is implantation of a protocol for risk screening that gives the anesthesia provider specific instructions on medications to administer; this has been demonstrated to reduce PONV.[10]

While several centers have published data related to PONV prophylaxis and effectiveness in reducing the risk of PONV, we lack an understanding of how practice varies between sites of care and how our practice compares to current guidelines. Elucidating the degree of practice variability attributable to type of anesthesia provider, site of care and PONV risk factors will help guide further interventions at reducing PONV. Adherence to national practice guidelines has the potential to improve the patient experience and decrease health care costs, and has been used internationally as a national quality metric.[11] Additionally, anecdotally we have observed that PONV medications are not administered at the recommended time during an anesthetic, which may result in reduced efficacy of PONV prophylaxis. Obtaining administration timing data for PONV medication on a large scale will make it possible to assess current practice patterns and possibly identify areas for improvement. While PONV is not currently a quality metric utilized at a national level in the United States, it is an area of the surgical patient experience where anesthesiologists are uniquely positioned to improve health care quality.

How will this project address this gap and advance clinical care and/or research knowledge?

This study intends to determine the relationship between the number of PONV prophylactic medications administered, the site of care, the type of anesthesia provider and PONV risk factors. This may help guide future interventions to improve the national perioperative experience by reducing PONV.

Methods

We will include all patients over the age of 18 who have undergone an elective general anesthetic for elective non-cardiac surgery. All operations performed between 2004 and 2012 within all multicenter perioperative outcome group (MPOG) sites of care collecting necessary preoperative and intraoperative data elements will be included (University of Michigan, Oregon Health and Sciences University, University of Colorado, University of Tennessee, Vanderbilt University, University of Utah). We will utilize the MPOG database to extract risk factors for PONV (Table 1) and PONV prophylactic medications administered (Table 2). For each MPOG record that meets our inclusion criteria of age over 18 and having received a general anesthetic, we will extract the following data: uniquely coded site of care (institution and type of facility), anesthesia provider type (attending only, attending and resident anesthetist, attending and CRNA, attending and resident and CRNA), specified PONV prophylactic medications including dose and time of administration, start and stop times of procedure, age, weight, and risk-modifying factors. Risk-modifying factors will include tobacco use history, gender, other PONV risk factors, performance of a regional block, long-acting intraoperative opioid administration, NSAID administration, presence or absence of end-tidal nitrous oxide and volatile agent, surgical duration and high risk surgical procedure (Table 3). Risk-modifying factors will be divided into those typically used to calculate a risk score (gender, tobacco use history, age, PONV history, long-acting intraoperative opioids) and the remaining risk-modifying factors. Additionally, we will request the PONV guidelines and/or protocols from each institution and determine if there differences between these policies that would contribute to variability between institutions. We will perform statistical analyses as described in the statistical analysis section.

IRB statement

We anticipate that this protocol will meet criteria for IRB exemption as there are no care interventions and all protected health information will be removed prior to analysis. Each center contributing data has an approved performance site IRB approval and the University of Michigan has a coordinating center approval for MPOG.

Study type

Observational, retrospective

Primary outcome

PONV prophylactic medications administered pre- or intra-operatively.

Secondary outcome(s), where applicable

Recommended PONV medications to be administered to 5 prototypical patients with 0-4 risk factors stratified by site based on PONV policies.

Patient inclusion criteria

Patients 18 years and older undergoing general anesthesia.

Patient exclusion criteria

- Patients under the age of 18.
- Emergency cases as denoted by ASA physical status modifier
- Patients that had the endotracheal tube left *in situ* at end of procedure
- Procedures performed using primary neuraxial, regional, or sedation technique
- Cardiac surgery

Data source

MPOG database

OHSU: No PACU data available.

Colorado: No PONV risk scores documented, unreliable smoking documentation.

Utah: No PACU data available, has risk score documented.

Vermont: No PACU data available.

Oklahoma: No PACU data available, has all four risk factors documented.

Tennessee: Has risk factors documented.

Statistical analysis

General Principles

We will use descriptive statistics to assess outliers and the assumption of normality. Skew and kurtosis will be utilized to assess normality, with statistics above a value of 2.0 interpreted as a non-normal distribution. Dosage data points that are above three standard deviations away from the mean will be presumed to be due to erroneous data entry and will be removed. SPSS (SPSS Inc., Chicago, IL) will be used to perform statistical analysis.

Management of Missing Data

MPOG records that are missing data for essential variables will be removed from the analysis, which will be reported in a CONSORT diagram. The essential variables are defined as procedure start and stop time, age and gender. Data for the primary outcome will be analyzed with and without smoking history included in the model to assess the impact of missing smoking history data. Similarly, the primary outcome will be analyzed with and without the risk-modifying factors that are not included in the risk score.

Primary Outcome

Univariable and multivariable poisson regression analysis will be used to determine the relationship between the number of PONV prophylactic medications administered and the type anesthesia provider (attending only, attending and resident, attending and CRNA, attending and resident and CRNA), site of care (institution and type of facility), risk score and risk-modifying factors. The number of PONV prophylactic medications will be the dependent variable. The type of anesthesia provider and site of care will be treated as categorical factors. Risk scores will be treated as ordinal covariates. Other risk-modifying factors will be treated variously as binary, categorical, ordinal or numeric factors. Medication administration time will be coded as "before surgery" if given before the start of the procedure, "first half" of surgery if given before the halfway point between procedure start and procedure finish, "second half" if given after the halfway point but before procedure finish. Dose data will be explored to determine if weight-base dosing is being utilized rather than fixed-dose administration.
Multinomial univariable and multivariable logistic regression analysis will be used to determine the relationship between the PONV drug classes and the covariates identified above. The dependent variable will be the PONV drug class.

Secondary Outcomes

Descriptive statistics will be reported for the analysis of the number of PONV prophylactic medications that would be administered to each hypothetical patient under the guidelines used at each institution.

Power analysis

Given the exploratory nature of this proposal which intends to examine as much data as possible, we have not provided a power calculation.

Known limitations and areas for PCRC discussion

- PONV outcomes would be the ideal outcome to establish the impact of the variation in PONV prophylaxis
- Many centers are not submitting PACU clinical data or medications that prevents use of PONV outcome in this study
- Variation analysis by type of provider does not really address variation at the provider level. May need to use a mixed effects model with use of primary anesthesiologist provider ID and primary anesthetist provider ID as a random effect with patient and operative factors and center as fixed effects

- Each site may have a distinct PONV prophylaxis policy – as a result, the comparison from each center's data may underestimate the providers actual "compliance". It may be appropriate to measure compliance with each centers policy as a measure of "compliance" as opposed to national guidelines
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Table 1 – Patient Risk Factors for PONV

Factor	Notes
Current smoking	Factor in most risk scores
PONV Risk Total Score	Survey to define by institution
General – PONV Risk Factors	Survey to determine how this field is being utilized
Patient sex	Factor in most risk scores
Hx PONV	Factor in most risk scores
Age	Factor in most risk scores
Performance of regional block	Risk modifying factor, negative
NSAID administration, intra-operative or pre-operative	Risk modifying factor, negative
Intra-operative opioid administration	Excluding epidural opioids Risk modifying factor, positive
Volatile anesthetic administration	Risk modifying factor, positive. Five consecutive ET% > 0% defined as 'administered'
Nitrous oxide administration	Risk modifying factor, positive. Five consecutive ET% > 0% defined as 'administered'
Surgical duration, 30 minute increments	Risk modifying factor, positive
High risk surgical procedure	See Table 3 Risk modifying factor, positive

Table 2 – PONV Prophylactic Medications

Drug	Notes
Ondansetron	
Dolasetron	
Granisetron	
Aprepitant	
Fosaprepitant	
Propofol infusion	When being used in conjunction with volatile anesthetic for PONV prevention (OHSU, Colorado)
Dexamethasone	
Promethazine	
Prochlorperazine	
Droperidol	
Haloperidol	
Scopolamine/Scopolamine Patch	
Diphenhydramine	
Ephedrine	IM only

Table 3 – High Risk Surgical Procedures

Surgery Type	Anesthesia CPT Code
Laparoscopy/Laparotomy/Abdominal	00702, 00750, 00752, 00754, 00756, 00790, 00792, 00794, 00796, 00797, 00830, 00832, 00840, 00860, 00862, 00880
Breast	00402, 00404, 00406
Plastic Surgery	00102, 00103, 00172, 00400

Maxillofacial	00120, 00126, 00190, 00192
Gynecological	00844, 00846, 00848, 00851, 00942, 00944, 00948, 00950, 00952
Neurologic	00210, 00212, 00214, 00215, 00216, 00218, 00220, 00222, 00600, 00620, 00622, 00630, 00632, 00670
Ophthalmologic/Strabismus	00140, 00142, 00144, 00145, 00147
Urologic	00864, 00865, 00866, 00868, 00870, 00872, 00873, 00906, 00908, 00910, 00912, 00914, 00918, 00920, 00921, 00922, 00924, 00926, 00928, 00930, 00932, 00934, 00936, 00938, 00940,

Ad hoc Variables to be collected

MPOG ID	Description	Type
General_yn	Whether case received a general anesthetic	Standardized Views; Anesthesia Technique
Block_yn	Whether case received a block	Standardized Views; Anesthesia Technique
70128	History - Social History - Tobacco	Preoperative Observations
71100	History - Social History - Tobacco Details Pack Years	Preoperative Observations
71110	History - Social History - Tobacco Details Current vs Past	Preoperative Observations
70338	General - PONV Risk Factors	Preoperative Observations
70339	General - PONV Risk Total Score	Preoperative Observations
50644	Misc - PONV prophylaxis administered	Intraoperative Events Interventions and Observations
3225	Flows Nitrous Oxide (L/min)	Physiologic Observations
3255	Nitrous Exp %	Physiologic Observations
3270	Sevoflurane Exp %	Physiologic Observations
3260	Isoflurane Exp %	Physiologic Observations
3280	Desflurane Exp %	Physiologic Observations
10377	PROPOFOL	Intraoperative Medications (Administered Mixtures)
10378	PROPOFOL W/ REMIFENTANIL 10 MG/ML + 5 MCG/ML	Intraoperative Medications (Administered Mixtures)
10453	PROPOFOL W/ KETAMINE 10 MG/ML + 1 MG/ML	Intraoperative Medications (Administered Mixtures)
10572	PROPOFOL W/ KETAMINE 10MG/ML + UNSPECIFIED KETAMINE	Intraoperative Medications (Administered Mixtures)
10577	PROPOFOL W/ KETAMINE 10 MG/ML + 0.5 MG/ML	Intraoperative Medications (Administered Mixtures)
10578	PROPOFOL W/ KETAMINE 10 MG/ML + 1.5 MG/ML	Intraoperative Medications (Administered Mixtures)
10579	PROPOFOL W/ KETAMINE 10 MG/ML + 2 MG/ML (Administered Mixtures)	Intraoperative Medications
10597	PROPOFOL W/ ALFENTANIL 10 MG/ML + 50 MCG/ML	Intraoperative Medications (Administered Mixtures)
10639	PROPOFOL W/ REMIFENTANIL 10 MG/ML + 10 MCG/ML	Intraoperative Medications (Administered Mixtures)
10649	PROPOFOL W/ REMIFENTANIL 10 MG/ML + 20 MCG/ML	Intraoperative Medications (Administered Mixtures)
10597	PROPOFOL W/ ALFENTANIL 10 MG/ML + 50 MCG/ML	Intraoperative Medications (Administered Mixtures)

10239	KETOROLAC	Intraoperative Medications (Administered Mixtures)
10414	SUFENTANIL	Intraoperative Medications (Administered Mixtures)
10020	ALFENTANIL	Intraoperative Medications (Administered Mixtures)
10186	FENTANYL	Intraoperative Medications (Administered Mixtures)
10306	MORPHINE	Intraoperative Medications (Administered Mixtures)
10219	HYDROMORPHONE	Intraoperative Medications (Administered Mixtures)
10390	REMIFENTANIL	Intraoperative Medications (Administered Mixtures)
10279	MEPERIDINE	Intraoperative Medications (Administered Mixtures)
10482	HYDROCODONE / ACETAMINOPHEN 5 MG / 325 MG	Intraoperative Medications (Administered Mixtures)
10483	HYDROCODONE / ACETAMINOPHEN 7.5 MG / 500 MG	Intraoperative Medications (Administered Mixtures)
10187	FENTANYL/MIDAZOLAM 40 MCG/ML / 200MCG/ML	Intraoperative Medications (Administered Mixtures)
10335	ONDANSETRON	Intraoperative Medications (Administered Mixtures)
10164	DOLASETRON	Intraoperative Medications (Administered Mixtures)
10208	GRANISETRON	Intraoperative Medications (Administered Mixtures)
10147	DEXAMETHASONE	Intraoperative Medications (Administered Mixtures)
10374	PROMETHAZINE	Intraoperative Medications

		(Administered Mixtures)
10373	PROCHLORPERAZINE	Intraoperative Medications (Administered Mixtures)
10169	DROPERIDOL	Intraoperative Medications (Administered Mixtures)
10210	HALOPERIDOL	Intraoperative Medications (Administered Mixtures)
10399	SCOPOLAMINE	Intraoperative Medications (Administered Mixtures)
10400	SCOPOLAMINE PATCH	Intraoperative Medications (Administered Mixtures)
160	DIPHENHYDRAMINE	Intraoperative Medications (Administered Mixtures)
10175	EPHEDRINE	Intraoperative Medications (Administered Mixtures)
10791	FOSAPREPITANT	Intraoperative Medications (Administered Mixtures)
10035	APREPITANT	Intraoperative Medications (Administered Mixtures)

20000	Unknown procedure room type	Procedure Room Types
20001	Other procedure room type	Procedure Room Types
20002	Acute care hospital - mixed use operating room	Procedure Room Types
20003	Acute care hospital - outpatient operating room	Procedure Room Types
20004	Acute care hospital - minor procedure room	Procedure Room Types
20005	Acute care hospital - remote interventional radiology procedure room	Procedure Room Types
20006	Acute care hospital - remote diagnostic radiology procedure room	Procedure Room Types
20007	Acute care hospital - remote minor procedure room	Procedure Room Types
20008	Acute care hospital - intensive care unit procedure	Procedure Room Types
20009	Attached ambulatory surgery center - outpatient operating room	Procedure Room Types
20010	Attached ambulatory surgery center - minor procedure	Procedure Room Types

	room	
20011	Attached ambulatory surgery center - remote minor procedure room	Procedure Room Types
20012	Freestanding ambulatory surgery center - outpatient operating room	Procedure Room Types
20013	Freestanding ambulatory surgery center - minor procedure room	Procedure Room Types
20014	Freestanding ambulatory surgery center - remote minor procedure room	Procedure Room Types
20015	Office based anesthesia operating room	Procedure Room Types
20016	Pediatric acute care hospital - mixed use operating room	Procedure Room Types
20017	Pediatric acute care hospital - outpatient operating room	Procedure Room Types
20018	Pediatric acute care hospital - minor procedure room	Procedure Room Types
20019	Pediatric acute care hospital - remote interventional radiology procedure room	Procedure Room Types
20020	Pediatric acute care hospital - remote diagnostic radiology procedure room	Procedure Room Types
20021	Pediatric acute care hospital - remote minor procedure room	Procedure Room Types
20022	Pediatric acute care hospital - intensive care unit procedure	Procedure Room Types
20023	Obstetrics - labor and delivery room	Procedure Room Types

20024	Obstetrics - operating room	Procedure Room Types
20025	Acute care hospital - labor and delivery room	Procedure Room Types
20026	Acute care hospital - obstetric operating room	Procedure Room Types

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