Post-operative Nausea and Vomiting Outcomes Assessment: Using Local Outcomes Data to Drive Changes in Clinical Practice

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Abstract

Objectives: The purpose of this paper is to use post-operative nausea and vomiting (PONV) as an example of how local data from an outcomes assessment can provide compelling evidence to initiate change in practice to improve patient outcomes.

Methods: Surgical patients requiring an inpatient recovery of at least one night were interviewed between two to six hours and six to 24 hours post-operative for signs and symptoms of PONV. A chart review was completed to capture anesthesia related factors known to contribute to PONV.

Results: The rate of PONV is 17.0%. Eighty-six percent of surgical patients received PONV prophylaxis. 85% of low PONV risk patients, 63.2% of moderate PONV risk patients and 66.6% of high PONV risk patients received prophylaxis non-compliant with PONV guidelines. The majority, 62.1% of patients, who received ondansetron and dexamethasone as PONV prophylaxis were administered both medications at the same time. Patients who received spinal anesthesia had a PONV rate of 24.5%. PONV occurred in 35.3% of female patients who received spinal anesthesia.

Conclusions: Prophylaxis based on PONV risk factors was inconsistent. A cumulative risk factor score should be calculated for each patient prior to surgery. Antiemetic selection and administration timing should be based on guideline recommendations. Women receiving spinal anesthesia should be prophylaxed as high PONV risk. Development of local outcomes assessments in response to clinical problems can drive change in clinical practice.

Current clinical practice is driven to a great extent by evidenced based medicine. Evidence in the form of published randomized, placebo controlled trials helps in the development of guidelines for practice in many clinical circumstances. Adoption of the guidelines is dependent on knowledge of the guidelines and willingness to change practice as necessary. It may be difficult to change a practice that is seemingly successful.

Post-operative nausea and vomiting (PONV) is frequently experienced by surgical patients.[1] A set of anesthesia and patient related risk factors for PONV and strategies to minimize PONV have been studied extensively in many randomized controlled trials. With the results of these trials the Society of Ambulatory Anesthesia has published guidelines for the use of antiemetic prophylaxis in surgical patients.[1,2]

The guidelines require a patient assessment of risk factors for experiencing PONV. Several risk factors are identified; female gender, history of PONV/motion sickness, age < 50 years, and non-smoking status as listed in Table 1. Each of these risk factors have been validated to increase risk of PONV. However, the risk assessment should consider a cumulative risk. In addition, surgery related risk factors should be assessed and are also included in Table 1. From the assessment patients should be considered low, medium, or high risk for PONV. The guidelines do not indicate a score to determine low, medium, or high risk. Patients determined to be low risk may not receive PONV prophylaxis. However, if the low risk patient expresses concern for PONV then a single prophylactic agent may be used. For medium risk patients one or two prophylactic agents from different pharmacologic classes can be used. For high risk patients three prophylactic agents should be used, all from different pharmacologic classes. In addition, for high risk patients general anesthesia should be avoided if possible and propofol should be used in induction or anesthesia. The guidelines indicate that timing of 5-HT3 antagonist administration should be at the end of surgery and dexamethasone administration should be administered prior to induction.

PONV prophylaxis guidelines have been in place for some time with the most recent version being published in 2014.[2] Incorporating revised guidelines into practice can be challenging at times. In our case, pre-operative workflows are streamlined and seem to work well. It takes some effort to change these workflows or order sets and evidenced based medicine may not be compelling enough to motivate change or providers may be unaware of

TABLE 1. Risk Factors for PONV[2]

Patient related	*Score*	*Anesthesia/surgery related*	*Score*
Female gender	1	General anesthesia use	1
Non-smoking status	1	Propofol use	-1
< 50 years of age	1	Nitrous oxide use	1
History of PONV/motion sickness	1	Use of volatile anesthetics	1
		Intrathecal or epidural opioid use	1

TABLE 2. Frequency of Vomiting by Total Patient Risk Factors and PONV Prophylaxis

Patient Risk Factors	*# Patients*	*Patients With No Prophylaxis*		*Patients With Prophylaxis*	
		Total	# Vomited	Total	# Vomited
0	9	0	0	9	0
1	31	6	1	25	2
2	39	5	2	34	8
3	18	2	1	16	3
4	3	1	0	2	0
	Total:	14	4	86	13
	% Vomiting:		28.6%		15.1%

TABLE 3. Frequency of Vomiting by Cumulative Risk Factor and PONV Prophylaxis

		Patients With No Prophylaxis		*Patients With Prophylaxis*	
Risk	**# Patients**	**Total (%)**	**Vomited**	**Total (%)**	**Vomited**
Low	19	14 (73.6%)	1 (7.1%)	5 (26.3%)	1 (20.0%)
Moderate	55	48 (87.3%)	9 (18.8%)	7 (12.7%)	2 (28.6%)
High	26	24 (92.3%)	3 (12.5%)	2 (7.7%)	1 (50.0%)

revised guidelines. However, local data that ties practice to outcomes can be compelling enough to cause change in the most routine processes. This paper examines the use of outcomes data to drive practice changes. The example used is prophylaxis in PONV but the principles can be used in post-operative pain, optimal therapy for congestive heart failure, etc.

Methods

Beginning May 23, 2016 surgical patients that required an inpatient recovery of at least one night post-operation were interviewed. Patients who were undergoing a cesarean section or patients unable to communicate were excluded from this assessment. Each patient was interviewed between two and six hours post-op and again on post-op day one. The purpose of these interviews was to identify patient specific risk factors for PONV, and the presence of any PONV symptoms. Patient specific risk factors are listed in Table 1. Surgical related risk factors were identified via chart review and are also listed in Table 1. Antiemetic agents given during the pre or intra-operative period were identified and considered prophylactic doses, while any doses given after the operation was complete were considered rescue doses. All data was recorded on a questionnaire which can be found in Appendix 1.

Appendix 1 is located here:

http://www.pswi.org/Communications/The-Journal/JPSWJF17_PONV-form

Results

From May 23rd to July 20th a total of 100 patients were interviewed. Of the 100 patients, vomiting occurred in 17 (17.0%) of patients. There were a total of 14 patients that did not receive prophylaxis and and 4 of those vomited (28.6%). A total 86 patients (86.0%) did receive prophylactic antiemetic therapy, and 13 of those patients vomited (15.1%). PONV rates by patient risk factor and prophylaxis are provided in Table 2. A cumulative risk assessment which included both patient related and anesthesia/surgery related risk factors was made using the scoring described in Table 1. A score of 0-1 was assigned low risk, 2-4 was assigned moderate risk, and greater than 4 was assigned high risk. Table 3 shows the prophylaxis rate and vomiting rate by low, moderate, and high cumulative risk. A cumulative risk assessment that includes both patient risk and anesthesia/surgery risk predicts PONV better than patient risk factors alone.

There were 80 patients who received prophylactic ondansetron and all 80 received this dose intra-operatively. There were 63 patients who received prophylactic dexamethasone, only 6 patients received this dose prior to surgery and none of the 6 experienced PONV. Of the 57 patients who received dexamethasone intra-operatively, 9 (15.8%) experienced PONV.

Fifty-eight patients (58%) underwent an orthopedic surgical procedure (Table 4). The remaining 42 patients (42%) underwent a variety of procedures including thyroidectomy, colectomy, hysterectomy, appendectomy, etc and are categorized as "general surgery." Of the orthopedic surgical patients, 14 patients (24.1%) vomited. Specifically, 9 patients (25.0%) that underwent a total knee arthroplasty and 4 patients (33.3%) that underwent a total hip arthroplasty vomited, and one patient (33.3%) undergoing a hip endoprosthesis vomited . A total of 3 patients (7.1%) that underwent general surgery vomited.

Forty-seven patients (47%) received general anesthesia, while 53 patients (53%) received epidural or intrathecal anesthesia (Table 5). Vomiting occurred in 13 patients (24.5%) who received intrathecal/epidural anesthesia, and in 4 patients (8.5%) who received general anesthesia. Vomiting occurred in 9 patients (20.0%) that had received intrathecal/epidural anesthesia and prophylaxis, and in 4 patients (9.8%) that received general anesthesia and prophylaxis. In patients not receiving any prophylaxis, 4 patients (50.0%) who received intrathecal/epidural anesthesia vomited, whereas no patients receiving general anesthesia vomited.

Of the 86 patients who were prophylaxed, 66 received propofol. The PONV rate in prophylaxed patients who

TABLE 4. Summary of Patient PONV Based on Surgery Type

Surgery Type	*Total*	*No Vomiting*	*Vomited*
General Surgeries	42	39	3 (7.1%)
Orthopedic Surgeries	58	44	14 (24.1%)

TABLE 5. PONV Rates Based on Anesthesia Type and Prophylaxis

	# Patients	Patients With No Prophylaxis		Patients With Prophylaxis		Total
Anesthesia Type		Total	# Vomited	Total	# Vomited	# Vomited
General	47	6	0	41	4 (9.8%)	4 (8.5%)
Epidural/Intrathecal	53	8	4 (50.0%)	45	9 (20.0%)	13 (24.5%)

received propofol was 10.6% and the PONV rate was 30% in prophylaxed patients who did not receive propofol (Table 6).

Fifty-eight patients (58.0%) were female and 42 patients (42%) were male. There were 15 female patients (25.9%) that vomited compared to 2 male patients (4.8%) that vomited (Table 7).

A total of 34 female patients received intrathecal/epidural anesthesia, with 12 patients (35.3%) vomiting (Table 8). Three female patients (12.5%) vomited that did not receive any intrathecal/epidural anesthesia. Twenty-eight female patients receiving intrathecal medications were prophylaxed (82.4%) while 6 patients (17.6%) received no prophylactic anti-emetics. In female patients who received prophylaxis and intrathecal/epidural

TABLE 6. Vomiting in Prophylaxed Patients Based on Propofol Administration

	# Patients	No Vomiting	Vomited
No Propofol	20	14	6 (30.0%)
Propofol	66	59	7 (10.6%)

TABLE 7. PONV Rates Based on Gender

Gender	# Patients	No Vomiting	Vomited
Female	58	43	15 (25.9%)
Male	42	40	2 (4.8%)

medications, there were 9 patients (32.1%) that vomited and 19 patients (67.9%) that did not vomit. In comparison, 3 women (13.6%) who received prophylaxis and general anesthesia vomited.

Discussion

This outcomes assessment was performed in response to comments made by inpatient nursing and orthopedic staff that patients may be vomiting more frequently after surgery than in the past. The results of this assessment show the PONV rate at Monroe Clinic Hospital is 17%, a reduction from the 2009 outcomes assessment data that determined a PONV rate of 23.5%. While the reduction in PONV incidence is encouraging, there are still opportunities for improvement with prophylaxis strategy and timing that have the potential to further reduce the incidence of PONV.

Increasing numbers of risk factors can increase the risk of PONV to as high as 80%.[2] As evidenced by this assessment, antiemetic prophylaxis decreases the rate of PONV. Prophylaxis based on cumulative risk factors is an effective way to reduce PONV rates. Guidelines for PONV prophylaxis are based on low, moderate, and high risk for PONV as determined by cumulative risk factors of 0-1, 2-4 and >4, respectively. Guidelines indicate that low PONV risk patients should receive no prophylaxis unless the patient expresses concern for potential PONV. Moderate PONV risk patients should receive two prophylactic agents from a different class or one prophylactic agent and total intravenous anesthesia. High PONV risk patients should receive a minimum two prophylactic antiemetic agents from a different class and total intravenous anesthesia. When prophylaxis is given, dexamethasone should be given at anesthesia induction and ondansetron should be given at the end of surgery.[2]

Eighty-six percent of patients received prophylactic antiemetic medications. Patients at low PONV risk often received more prophylactic medications than necessary. Patient preference, which could not be determined from the chart, prevents the quantification of over prophylaxis in this group. Timing of the administration of dexamethasone was also inconsistent with guideline recommended timing. This data suggests that our prophylaxis strategies can be improved to be more consistent with recommendations in the PONV guidelines.

Standardization of prophylaxis strategies would help improve patient PONV outcomes. Beginning at pre-surgical appointments, cumulative risk factors should be calculated and documented for anesthesia staff to use on the day of surgery. With this number anesthesia can determine the number of antiemetic agents to administer, whether the use of total intravenous anesthesia is necessary and the correct timing of antiemetic administration based on guideline recommendations.

Standardization of prophylaxis strategies in all surgical patients would help reduce PONV rates overall, but special attention must be given to patients undergoing orthopedic procedures. Results show orthopedic surgical patients had higher PONV rates, likely due to the use of spinal anesthesia. Patient's receiving spinal anesthesia experience PONV rates up to 74%.[3] Overall, female patients experienced PONV almost twice as often as male patients and female patients who received intrathecal/epidural medications had a greater PONV rate than females who received general anesthesia. In prophylaxed female patients, those who received intrathecal/epidural anesthesia experienced PONV more often than those who received general anesthesia. This data suggests that the combination of spinal anesthesia and female gender is highly predictive of PONV. These female patients should be treated as high risk, regardless of their

TABLE 8. PONV Rates in Females Based on Anesthesia Type and Prophylaxis

	# Patients	Patients With No Prophylaxis		Patients With Prophylaxis	
Anesthesia Type		Total	# Vomited	Total	# Vomited
General	24	2	0	22	3 (13.6%)
Epidural/Intrathecal	34	6	3 (50.0%)	28	9 (32.1%)

cumulative risk factor score.

To reduce PONV rates in spinal anesthesia patients, especially females the use of propofol for anesthesia induction may be considered. Propofol has an antiemetic effect and may be beneficial for patients at a high-risk of developing PONV. Patients who received propofol as a part of their anesthesia regimen experienced lower rates of PONV than patients who were not administered propofol.

Conclusions

PONV rates at Monroe Clinic Hospital are low compared to data from years past. Areas for PONV rate improvement identified by this assessment included prophylaxis strategy, timing of prophylaxis administration and risk categorization of women receiving spinal anesthesia. From the identification of these improvement areas, recommendations were developed to standardize prophylaxis strategies. These recommendations include screening of all surgical patients in their pre-operation appointments to determine their cumulative PONV risk factors. After determination of cumulative risk factors, each patient should be categorized as low, moderate or high PONV risk. All female patients undergoing an orthopedic procedure and receiving spinal anesthesia should be automatically categorized as high risk based on our local data. Once categorized, patients should receive the guideline recommended number of antiemetic agents at the appropriate timing. Adoption of this recommended prophylaxis strategy may allow for improved patient PONV outcomes. In addition to improving PONV outcomes, this assessment provided an example of how pharmacists can analyze a clinical problem and provide recommendations that have the potential to largely improve patient care.

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*original*contributions

Resource Table for the Management of Adults With Hospital-acquired and Ventilator-Associated Pneumonia: 2016 Clinical Practice Guidelines

by Michael W. Nagy, PharmD, Melissa E. Heim, PharmD, BCCCP, and Susanne Barnett, PharmD, BCPS

The following table serves as a comparison of the 2005 Infectious Disease Society of America (IDSA) Hospital-acquired, Ventilator-associated, and Healthcare associated Pneumonia (HAP/VAP/HCAP) guidelines to the newly published 2016 HAP/VAP guidelines published on July 14, 2016.[1,2] The 2016 guidelines recognized that the term HCAP is too broad and not all patients with HCAP should receive triple antibiotic therapy. Specifically, some risk factors are more closely associated with multi-drug resistance (MDR) organisms than others. Since HCAP patients are triaged in the emergency department it is suggested that the treatment of HCAP be addressed in the next iteration of the Community-acquired Pneumonia (CAP) guidelines. Additionally, patient characteristics associated with MDR organisms are differentiated in the new guidelines between HAP and VAP, and are an important determinant in guideline-recommended empiric therapy for Staphylococcus aureus and Pseudomonas aeruginosa. Instead of blanket methicillin-resistant staphylococcus aureus (MRSA) and double antipseudomonal coverage for all HAP/VAP patients, an emphasis is placed on local antibiograms and resistance patterns.