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Validation of Simplified Postoperative Nausea and Vomiting Intensity Scale in Taiwan

Short title: Validation of Simplified PONVIS

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ABSTRACT

Purpose: This study determined whether the Simplified Postoperative Nausea and Vomiting Impact Scale (SPONVIS), could be used to predict clinically important PONV in Taiwanese.

Methods: In this prospective, observational study, SPONVIS, simplified Apfel PONV Risk Scores, post-operative anti-emetic drug use, total PONV score, and 3-month recall score for PONV were recorded from Taiwanese patients who had undergone general anesthesia and surgery. With antiemetic use and 3-month recall score as validations of clinical significance, we determined whether the elements and cut-off points used in the original SPONVIS study could be used in Taiwanese patients.

Results: A total of 378 patients were included in the analysis. One hundred forty (37.1%) patients had PONV. Forty-eight patients (12.7%) had clinically important PONV (SPONVIS score ≥ 5). The odds ratios were 14.26 (CI: 6.91-29.43; $P < 0.001$) and 4.95 (CI: 2.42 to 10.11; $P < 0.001$), respectively, for prediction of anti-emetic drug use and 3-month recall. The SPONVIS and its construct elements were significantly related to anti-emetic drug use, 3-month recall score for PONV, total PONV score, and Apfel risk score (all $p \leq 0.005$), results similar to those reported in the original Australian PONV impact score study. The SPONVIS cut-off points 3 and 5 were statistically significant predictors of anti-emetic drug use. However, a cut-off point of 3 had a higher OR (24.08) than a cut-off of 5 (14.26) for prediction of anti-emetic drug use.

Conclusion: SPONVIS and both construct elements (the nausea and vomiting impact scores) are useful predictors of clinically important PONV in Taiwanese.

Key words: post-operative nausea, post-operative vomiting, PONV, anti-emetic drugs, risk scoring, intensity scoring, impact scoring

INTRODUCTION

Postoperative nausea and vomiting (PONV) is a common complication following anesthesia and may complicate and delay recovery. A number of studies have examined risk factors for identifying PONV and devised scoring systems to determine its probability and to assess its severity [1-4]. Because the initial scoring systems, designed for the use of research scientists, were often too complex for routine clinical use, they were simplified for easy clinical use [2, 5]. These scoring systems were sensitive indicators of the risk of occurrence of PONV, but had a low adherence rate clinically [6]. They did not address the question of how to identify clinically important PONV, that is, PONV that requires medical treatment. The ability to identify clinically important PONV would ensure earlier and more intensive preventive treatment to be given to such patients, lessen PONV-related complications and prevent the extended hospital stay that might otherwise occur.

In 2010, Wengritsky et al reported a PONV Intensity Scale (PONVIS) based on nausea severity, nausea duration, and number of vomits [7]. In 2012, a simplified version of this scale was published, based on nausea severity, duration and number of vomits or retches, which was called the simplified PONV Impact Scale (SPONVIS). When the authors used this scale to evaluate clinically important PONV [8], they reported that only 1 in 5 patients with PONV actually reached clinically important PONV.

In the same data from the same patients, the identification of high risk patients may differ, depending on the criteria used for this identification [9]. Also, a scale that is validated on one population should not be used on an ethnically and culturally different population without being re-validated on this population, because the relative weights of the risk factors used to determine the score will not be the same for all populations [9,10]. And whether PONV needs to be treated

or not depends on the patient's subjective perception of its severity. In performing a comparison of the applicability of five scoring systems for PONV risk for Taiwanese patients [11], we found that only two of the four risk factors used in the simplified Apfel and Koivuranta scoring systems, gender and PONV/motion sickness history, were significant independent PONV risk factors in the Taiwanese patients. In addition, 19% of the patients in this study reported, in the pre-operative evaluation, that they had had previous PONV experience. Also, some of patients asked, during the preoperative interview, that prohibition of PONV be considered a priority in their treatment. These considerations made us decide to include 3 month post-operative recall as an additional validation factor in the study reported here.

In current study, we examined whether the SPONVIS and its construct elements can be used in Taiwanese patients to predict PONV severe enough to be clinically important, that is, PONV that necessitates the use of anti-emetic drugs.

METHODS

The data used for analysis in this manuscript were collected during a 6 month period, between June and December, 2014, from a 1000-bed tertiary teaching hospital. The subjects were part of a larger, longitudinal study, begun in 2009, to observe outcomes related to general anaesthesia. This pilot study was part of a study plan, patients from a six month period of the study were recruited and 3-month recall was introduced as the end point additionally. Approval for the parent study was granted in 2008 by the Ethics Committee of Chia-Yi Christian Foundation (Ditmanson Medical Foundation Chia- Christian Hospital IRB-97028; 11/11/2008 and renewed every year to 2016). Patients who were scheduled for thyroid cancer, breast cancer, intra-thoracic, intra-abdominal, bariatric surgery, orthopedic , or ear, nose and throat surgery, who were more than 20 years of age, who could communicate well, and who were scheduled for

general anaesthesia were invited to join this the study. Those who were undergoing emergency surgery or who could not communicate well were excluded. The acceptance rate was around 40-70%, and all subjects signed informed consent forms prior to enrollment.

Baseline data collected were age, gender, body weight, height, calculated body mass index, ASA score, smoking status, a history of motion sickness or previous PONV, and use of the following postoperative rescue antiemetic drugs: droperidol, dexamethasone, dimenhydrinate, naloxone, metoclopramide or granisetron. Data were collected on the day before surgery, the day of surgery, and the day after surgery, by two trained research assistants. Anesthesiology was performed by members of the authors' anesthesia team, but the two assistants who collected the data were not part of the authors' anaesthesia team and worked independently. The 3-month recall data were collected through a follow-up phone interview by the same two assistants.

Anaesthesia and data collection

Patients received general anaesthesia, with or without fentanyl, using propofol (1 to 2 mg/kg) or sodium thiopentone (3 to 5 mg/kg), and neuromuscular blockade with atracurium or rocurium for intubation (reversal with atropine 1.0 mg and neostigmine 2.5 mg). No preoperative sedative, analgesic or antiemetic drugs were given before anesthesia induction, according to clinical practice at our hospital the time of the study. All patients were intubated and supervised by one individual anaesthesiologist according to routine practice. Patients received volume-controlled ventilation in a semi-closed system with a tidal volume of 7 to 12 ml/kg and a frequency of 10 to 12 times/min. Anaesthesia was maintained with sevoflurane or desflurane; no nitrous oxide was used. During the operative procedure, the research assistant recorded the surgical procedure, the patient's progress, the anaesthetics used, and any adverse events. Use of opioids at the end of surgery, during the post-operative period, and in the first 24

hours after surgery was categorized as ”yes” or “no,” as described in the simplified risk scale devised by Apfel et al.[5]

The older, Rhodes Index of Nausea and Vomiting (RINV)[12] was used to record PONV intensity and duration, because the newer SPONVIS had not been published at the time the longitudinal study from which the current study was derived began. The vomiting/retching instances and nausea severity scores of the RINV scale were then transformed for use in determining the vomiting/retching and nausea impact scores of the SPONVIS scale. The transformation procedure is described in the next section.

Risk and severity score transformation and comparison

The SPONVIS assigns scores ranging from 0 to 3 for nausea severity impact and vomiting/retching frequency impact and sums these scores for a total impact score from 0 to 6[8]. To obtain SPONV scores from RINV data, the number of vomiting and/or retching episodes recorded in the RINV were transformed into SPONVIS vomiting/retching impact parameters as follows: no incidents = 0; one vomiting or retching incident = 1; two vomiting and/or retching incidents = 2; three or more vomiting and/or retching incidents = 3. The duration of moderate to severe nausea (nausea that interfered with daily activities of living some or most of the time) recorded in the RINV was transformed into SPONVIS nausea impact data as follows: none = 0; <1 hour = 1; 1-2 hours = 2; 3-4 hours = 3; >4 hours = 4. The sum of the nausea and vomiting/retching impact scores was the total SPONVIS score. The SPONVIS definitions of their numerical scores can be seen in Figure 1. The 3-month recall score for PONV severity used a VAS 0 to 10 scale for severity, 0 being no PONV and 10 being the most severe PONV possible, for the patient to quantify his/her recollection of the earlier PONV severity.

The Apfel simplified PONV risk scoring system gives scores of 1 each to female gender, history of motion sickness or PONV, non-smoking status, postoperative opioids usage, and sums them for a total PONV score of 0 to 4. We also compared our scores with those of the Apfel scoring system in predicting PONV risk. And the total PONV score, the simplified Apfel PONV risk score, and the 3-month recall score were examined as predictors for PONV severity.

Statistical analysis

The data are presented as mean ± standard deviation (SD) for age, median (range) for 3-month recall score, total PONV score, Myles PONV Impact Score, length of hospital stay, and frequency (%) for all categorical variables. Age difference between PONV and non-PONV groups was tested by independent t-test. Differences in 3-month recall score, total PONV score, Myles PONV Impact Score, and length of hospital stay were examined by Mann-Whitney U test for differences between two groups, or by Kruskal-Wallis test for differences between 3 groups or more. Differences in categorical variables between groups were confirmed by chi-square test or Fisher's exact test. Logistic regression model was implemented to estimate the risk of antiemetic use. The odds ratio (OR) and 95% confidence intervals (CIs) were reported.

Before performing logistic regression analysis, we merged (see Table 3) some severity categories of the SPONVIS impact scores because of the small (9 or less) number of patients in some categories. The width of 95% CI interval was also taken into account and the combinations with narrower 95% CI intervals were used for analysis. All statistical analyses were carried out using SPSS for Windows V22.0 (IBM Corp., Armonk, NY, USA). A two-sided P-value < 0.05 was considered statistically significant.

RESULTS

A total of 378 patients were enrolled in the analysis. One hundred and forty (37.0%) patients had occasions of nausea, vomiting, or retching. Patient characteristics are summarized in Table 1. Those with and those without PONV were similar in age, ASA score, and smoking history. However, the PONV group had a higher percentage of females ($P = 0.007$), and more patients in this group reported an experience of motion sickness ($P = 0.001$). There were 43 (11.4%) patients receiving anti-emetics on postoperative day 1, and a higher percentage of patients using antiemetics was found in the PONV than in the no PONV group ($P < 0.001$).

Table 2 shows data for all patients on the distribution of nausea impact, vomiting impact, and nausea/vomiting-retching impact scores in relation to antiemetic drug use, 3-month recall of PONV severity, simplified Apfel PONV risk score, and total PONV score. There were 14 patients with missing 3- month recall phone call data, and 53 patients who recalled PONV in these phone calls. The recall rate for nausea and vomiting was 11.5% (37/321) in patients with low (< 5) and 37.2% (16/43) those with high (≥ 5) nausea-vomiting/retching severity scores. Antiemetic drug use showed a significant relationship to severity for all 3 nausea and vomiting parameters; compared to the 50% to 70% of the patients with the highest scores who took antiemetic drugs, only 3% to 9% of patients with the lowest score 0 in each parameter used antiemetic drugs. The total PONV score, the median 3-month recall score and the Apfel risk score were also significantly related to all three nausea and vomiting scores.

Figure 1 compares the distribution of nausea impact, vomiting impact, and nausea/vomiting impact scores in PONV patients in our study with similar data from PONV patients in the SPONVIS study. The two groups of PONV patients differed markedly in that around 50% of Taiwanese patients but 97% of Australian patients studied reported nausea, and

77% of Taiwanese patients but only 49% of the Australian patients reported vomiting. Also, more Taiwanese patients than Australian patients reported severe vomiting (43% vs. 17%).

Table 3 shows the relationship between the three impact scores (nausea, vomiting-retching, combined nausea/vomiting-retching) and risk of antiemetic use. In comparison with the patients with no nausea, those with nausea of any severity were more likely to have taken antiemetics (OR= 13.02, 95% CI: 6.43-26.37, $P < 0.001$). And patients who had vomited more than once had a 25-times (95% CI: 11.55-53.82, $P < 0.001$) higher risk of antiemetic use than those had vomited once or not at all. Those with a nausea-vomiting impact score ≥ 3 had an OR of 22.08 compared with those with a score < 3 for risk of anti-emetic use. Those with a nausea-vomiting score of ≥ 5 (12.7%) had an OR of 14.26 for risk of anti-emetic use compared to those with a score < 5 (87.3%).

In Table 4, nausea/vomiting impact cut-off scores of ≥ 3 and ≥ 5 are compared as cut-off points for determination of clinically severe PONV in Taiwanese patients. A cut-off score of ≥ 3 was related to 3-month recall score and total PONV score. It was also very clearly related to anti-emetic drug use; 74% of those using anti-emetic drugs had nausea/vomiting impact scores ≥ 3. The higher cut-off score used in the SPONVIS impact study, ≥ 5, failed to predict 47% of those in our study who had used anti-emetics.

DISCUSSION

The current study aimed to examine whether the SPONVIS could be used in Taiwanese patients to assess clinically important PONV. We found that the three items used to construct the SPONVIS and determine clinically important PONV, nausea impact, vomiting/retching impact,

and nausea/vomiting-retching impact scores were significantly related to antiemetic use, 3-month recall score (a unique parameter used in our study), PONV score, and simplified Apfel score, except that the Apfel score could not be fully stratified (Table 2). The SPONVIS has therefore been validated to be useful in Taiwanese and may be useful in Asians. These impact scores will be important for future research and quality control of PONV and as a guide to use of rescue antiemetics.

The suggested cut-off point used in the SPONVIS study (≥ 5) to identify clinically important PONV failed to predict half of the Taiwanese patients taking anti-emetic drugs. In contrast, a lower cut-off for clinically important PONV used in our study, ≥ 3, successfully predicted the three quarters of Taiwanese patients that took anti-emetic drugs. The reason that the cut-off value of ≥ 5 identified 75% of the Australian patients taking antiemetics but only around 50 % in our study was because 97% of the PONV patients in our study experienced no nausea. Since the cut-off value is a composite score of the nausea/vomiting-retching impact score, that is, a sum of the 0-3 nausea impact and 0-3 vomiting-retching impact scores, it is impossible for a PONV patient who reported no nausea (score 0) to reach a nausea/vomiting impact score equal to or above 5 and be included in the clinically important PONV cohort as defined in the SPONVIS study. Clinically, the cut-off point 5 identified only 12.7% of our cases, which indicates that the higher cut-off point missed many cases with multiple vomiting episodes but with mild or no nausea. In contrast, the cut-off point 3 identified 18.8% (71 cases) of cases that received general anesthesia and would have clinically important (requiring anti-emetic drugs) PONV. A cut-off point 3 seems to be a better representation of clinical phenomena in Taiwanese patients. As believers of patient-centeredness, we hold that what patients care about should be clinically important. Because the SPONVIS study data and our data each had only a limited

number of case number (168 and 140 with PONV, respectively) more studies are needed to validate whether 3 is a better cut-off for clinically important PONV in Taiwanese.

The 3-month recall of PONV was for the first time validated to be a clinically important PONV outcome indicator. One reason is because although some patients claimed that PONV made them very distressful, few in the study mentioned that PONV affected clinically important outcome factors, such as activities of daily living. Thus PONV was regarded as a "big little problem" and a low use of preventive anti-emetics resulted. The high recall PONV in 3 months after operation 37. 1% in patients with a high SPONVIS score compared to 11.5% in those low scores (Odds ratio: 4.95; CI: 2.42-10.11) and higher anti-emetic drug prescription in patients who recalled clinically important PONV at 3 months after operation (8.4% without vs 26.4% with PONV; Odds ratio: 3.94; 1.90-8.17) shows that the 3-month recall is a good indicator for clinically important PONV.

Our PONV impact scores roughly corresponded to the Apfel simplified PONV risk scores, except that our scoring system distinguishes three different levels of PONV instead of the five levels in the simplified Apfel scoring system. While smoking counts as a significant risk factor for PONV in both Finnish and German patients, smoking was not a risk factor in Taiwanese patients in either our previous or our current study, nor was it a risk factor in a previous report that in which 35% of subjects were Chinese[13]. And in a study in South Africa, black South African ethnicity was found to be an additional independent (negative) risk factor for PONV[10].

Nausea and vomiting impact scores were differently distributed in Taiwanese and subjects in the 2012 SPONVIS study. That study, based on data from Australian patients, gave similar results when re-validated on Portuguese patients [14] and on Australian gynecological

patients[15]. However, the patients with clinically important PONV in the 2012 SPONVIS study and in our study may describe two different sets of patients. The difference in distribution of nausea and vomiting impact scores between that study and ours may results from multiple factors. We suspect that differences in medical and surgical procedures, and in ethnic and cultural aspects between Taiwanese and Australian patients may have contributed to differences in the nausea impact scores. Furthermore, since surgical procedures and post-operative care were not recorded in 2012 SPONVIS study, it is not clear whether differences in routine care procedures, such as differences in the frequency and intensity of opioid use, accounted for the differences in the results. Cultural differences between the two populations may have affected the patients' ratings of nausea severity, but further study is needed to substantiate this hypothesis. But, our results, when compared with those of other studies, suggest that even though a PONV risk or intensity/impact scoring system has been validated on more than one population, it should be re-validated before being used on a new ethnic or cultural group.

This study has limitations. One limitation was the small sample size, which although adequate for validating the parameters determining clinically important PONV, may have introduced sampling bias. Another limitation was that the study from which this study was derived was designed before SPONVIS had been reported and used the RINV to record PONV, so we had to transform RINV scores into SPONVIS scores for the current analysis. In a preliminary, unpublished, analysis to assess the accuracy of this transformation, we found that 75% of subjects with moderate or higher nausea distress on the RINV scale (grade 2 or above) had identical nausea severity grades on the SPONVIS, using our transformation rules. The transformation, although good, was therefore not perfect. However, the very high ORs found when SPONVIS scores of ≥ 5 or ≥ 3 were used as predictors of antiemetic drug use suggests that

the transformation between the two data systems did not compromise the results.

In conclusion, the two construct elements, nausea impact and vomiting impact and the resulting nausea-vomiting impact score from SPONVIS are useful in identifying clinically important PONV on the Taiwanese patients. The SPONVIS can be used as an indicator for anti-emetics prescription and quality improvement in Asians in the future.

Compliance with Ethical Standards

Disclosure of potential conflicts of interest

All authors declare no conflict of interest.

Research involving Human Participants and/or Animals

Approval for the parent study was granted in 2008 by the Ethics Committee of Chia-Yi Christian Foundation (Ditmanson Medical Foundation Chia- Christian Hospital IRB-97028; 11/11/2008 and renewed every year to 2016)

Informed consent

Patients who were scheduled for thyroid cancer, breast cancer, intra-thoracic, intra-abdominal, bariatric surgery, orthopedic , or ear, nose and throat surgery, who were more than 20 years of age, who could communicate well, and who were scheduled for general anaesthesia were invited to join this the study.

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Table 1.Patient characteristics (n=378)

Characteristics	**No PONV (n=238)**	**PONV (n= 140) †**	***P***
Age, years	54.1 ± 14.5	51.9 ± 15.7	0.172
<40	37 (50.0)	37 (50.0)	
40-49	44 (62.9)	26 (37.1)	
50-59	75 (72.8)	28 (27.2)	
60-69	45 (62.5)	27 (37.5)	
≥70	37 (62.7)	22 (37.3)	
Gender			**0.007**
Female	137 (57.6)	100 (42.2)	
Male	101 (71.6)	40 (28.4)	
Smoker			0.304
No	64 (67.4)	31 (32.6)	
Yes	174 (61.5)	109 (38.5)	
Motion sickness or PONV after analgesia			**0.001**
No	183 (68.5)	84 (31.5)	
Yes	55 (49.6)	56 (50.5)	
ASA score			0.578
1	39 (60)	26 (40)	
2	192 (63.2)	112 (36.8	
3	7 (77.8)	2 (22.2)	
Apfel score			**0.003**
0	27 (75.0)	9 (25.0)	
1	54 (72.0)	21 (28.0)	
2	76 (69.1)	34 (30.9)	
3	64 (52.9)	57 (47.1)	
4	17 (47.2)	19 (52.8)	
Postoperative antiemetic			**<0.001**

use			
No	230 (68.7)	105 (31.3)	
Yes	8 (18.6)	35 (81.4)	
3-month recall PONV			**<0.001**
No	219 (70.4)	92 (29.6)	
Yes	19 (35.8)	34 (64.2)	

Abbreviations: PONV= postoperative nausea or vomiting; ASA= American Society of Anesthesiologists

Mean and standard deviation are shown for age (years); number and row percentage are shown for other data

† PONV was defined if a patient had score ≥ 1 on either the nausea duration, nausea impact, vomiting impact, or nausea/vomiting impact scales.

Bold values indicate statistical significance.

Table 2. Tests of validity using nausea impact score, vomiting/retching impact score, and nausea-vomiting/retching impact among 3-month recall, postoperative nausea and (or) vomiting (PONV) and simplify Apfel score and atiemetic use in all patients (n= 378)

	Simplified Apfel score ≥ 3, n (%)	***P***	**3-month recall score, median (range)[1]**	***P***	**Total PONV score, median (range)**	***P***	**Antiemetic use, n (%)**	***P***
Nausea impact score		***0.005***		***<0.001***		***<0.001***		***<0.001***
0 (n= 308)	115 (37.3)		0 (0, 9)		0 (0,20)		15 (4.9)	
1 (n= 9)	6 (66.7)		0 (0, 10)		13 (8,20)		5 (55.6)	
2 (n= 52)	30 (57.7)		0 (0, 5)		13.5 (6,24)		16 (30.8)	
3 (n= 9)	6 (66.7)		2 (0, 6)		22 (21, 27)		7 (77.8)	
Vomiting/retching impact score		***<0.001***		***<0.001***		***<0.001***		***<0.001***
0 (n= 269)	95 (35.3)		0 (0, 5)		0 (0, 6)		9 (3.4)	
1 (n= 42)	21 (50.0)		0 (0, 9)		6 (3, 11)		2 (4.9)	
2 (n= 6)	3 (50.0)		0 (0, 0)		10 (8,13)		1 (16.7)	
3 (n= 61)	38 (62.3)		0 (0, 10)		18 (0, 27)		31 (50.8)	
Nausea-Vomiting/retching impact scale score		***0.001***		***<0.001***		***<0.001***		***<0.001***
0 (n= 265)	94 (35.5)		0 (0, 5)		0 (0, 6)		9 (3.4)	
1 (n= 32)	17 (53.1)		0 (0, 9)		6 (3, 9)		2 (6.3)	
2 (n= 10)	2 (20.0)		0 (0, 3)		8 (6, 9)		0 (0.0)	
3 (n= 15)	7 (46.7)		0.5 (0, 6)		10 (0, 20)		4 (26.7)	

4 (n= 8)	7 (87.5)	0 (0, 10)	14 (10, 20)	5 (62.5)
5 (n= 39)	24 (61.5)	0 (0, 5)	17 (9, 24)	16 (41.0)
6 (n= 9)	6 (66.7)	2 (0, 6)	22 (21, 27)	7 (77.8)

[1] There were 14 missing data for 3-month recall score.

Bold values indicate statistical significance.

For patients with grade ≥ 2 (moderate or higher distress from nausea) on the RINV scale, The SPONVIS nausea impact was graded according to the duration of the moderate to severe nausea distress: 0 (none) =0; < 1 hour = 1; 1-2 hours = 2; 3-4 hours = 3; > 4 hours = 3. The number of vomiting and retching incidents ono the RINV scale were summed in order to be transformed into the SPONVIS vomiting/retching impact score: No vomiting or retching = 0; one incident of retching or vomiting 1 = 1; two incidents of retching or vomiting = 2; more than 2 incidents of retching or vomiting = 3).

Table 3. Predictive validity of nausea, vomiting, and nausea-vomiting impact scores for antiemetic use (n= 378)

Characteristics	**Odds ratio (95% confidence interval)**	***P***
Nausea impact score		
0= No (n= 308)	Reference	
1 to 3 (n=70)	13.02 (6.43, 26.37)	**<0.001**
Vomiting (and/or retching) impact score		
0 to 1 (n= 311)	Reference	
2 to 3 (n= 67)	24.94 (11.55, 53.82)	**<0.001**
Nausea-vomiting impact score		
0 to 2 (n= 307)	Reference	
3 to 6 (n= 71)	22.08 (10.3, 47.31)	**<0.001**
Vomiting (and/or retching) impact score		
0 to 2 (n= 317)	Reference	
3 (n= 61)	26.26 (12.23, 56.42)	**<0.001**
Nausea-vomiting impact score		
0 to 4 (n= 330)	Reference	
5 to 6 (n= 48)	14.26 (6.91, 29.43)	**<0.001**

Bold values indicate statistical significance.

Table 4. PONV intensity score, 3-month recall score of PONV, total PONV score, hospital stay, and antiemetic use in accordance with clinically important PONV defined by postoperative 24-hr nausea-vomiting impact scale score (n= 378)

	Clinically important PONV defined by nausea-vomiting impact scale score ≥ 3			**Clinically important PONV as defined by nausea-vomiting impact scale score ≥ 5**		
	No (n= 307)	**Yes (n= 71)**	***p***	**No (n= 330)**	**Yes (n= 48)**	***p***
3-month recall score, median (range)	0 (0, 0)	0 (0, 2)	**<0.001**	0 (0, 0)	0 (0, 2)	**<.001**
Total PONV score, median (range)	0 (0, 0)	16 (12, 20)	**<0.001**	0 (0, 3)	18 (12.5, 21)	**<.001**
Hospital stay (days), median (range)	6 (4, 9)	6 (5, 8)	0.682	6 (4, 9)	6 (4, 8)	0.680
Antiemetic use, n (%)	11 (25.6)	32 (74.4)	**<0.001**	20 (46.5)	23 (53.5)	**<0.001**

[1] There were 14 missing data for 3-month recall score.

Bold values indicate statistical significance.

Figure legend:

Figure 1. Percentages in each severity category for A: nausea impact, B: vomiting impact and C: nausea/ vomiting impact score in patients with PONV. The Myles cohort includes only those with PONV (not all-comers).