Characterization of the prevalence and intensity of nausea and vomiting in postoperative period in a tertiary hospital: an observational study

João Pedro Sant'Anna Pinheiro[1,3*], Hugo Azevedo Duarte[2*], Felipe Bernardelli Marques[1*], Alcides Fernando Lemos Garcia[3], Bianca Barros Parron Fernandes[4], Karen Barros Parron Fernandes[5,6,7], Regina Célia Poli-Frederico[7,8], Marcos Tadeu Parron Fernandes[9].

[1] Graduate Student, School of Medicine, Pontifícia Universidade Católica do Paraná (PUCPR), Londrina-PR, Brazil.
[2] Graduate Student, School of Medicine, Masaryk University, Brno, South Moravian, Czech Republic.
[3] Medical Residence, Anesthesiology Department, Irmandade da Santa Casa de Londrina (ISCAL) Londrina-PR, Brazil.
[4] Undergraduate Student, School of Medicine, Pontifícia Universidade Católica do Paraná (PUCPR), Londrina-PR, Brazil.
[5] Manager of Research and Education, Institute of Education, Research and Innovation - Irmandade da Santa Casa de Londrina (IEPI-ISCAL), Londrina-PR, Brazil.
[6] Associate Professor, Université du Quebec à Chicoutimi (UQAC), Chicoutimi, QC, Canada.
[7] Associate Professor, Universidade Pitágoras Unopar (UNOPAR), Londrina-PR, Brazil.
[8] Associate Professor, Pontifícia Universidade Católica do Paraná (PUCPR), Londrina-PR, Brazil.
[9] Associate Professor, Anesthesiology Department, Irmandade da Santa Casa de Londrina (ISCAL), Londrina-PR, Brazil.

* Joint authorship – the individuals are considered first authors since they have the same contribution at the study.

Corresponding Author

Marcos Tadeu Parron Fernandes – MD, MsC, PhD
Serviço de Anestesiologia de Londrina
Rua Sen. Souza Naves, 441 sala 404 - Centro
Cep: 86010-929 - Londrina – PR, Brazil
E-mail: mparron@yahoo.com.br

Abstract - Introduction: Postoperative nausea and vomiting (PONV) are common complications of several surgical procedures, which are associated with both patient-related factors as the anesthetic-surgical procedure.
Aims: This study aimed to evaluate the occurrence and intensity of nausea and vomiting in the postoperative period from different surgeries related to the anesthetic technique and the use of drugs in the trans-operative period.
Methods: In this cross-sectional study, adults (age over 18 years) who underwent elective surgery at a tertiary hospital were included. Nausea and vomiting of Intensity Scale was applied within 12 and 24 hours after the interview.
Results: This study included 154 patients undergoing several different surgeries. The mean age of the study population was 44.24 ± 13.4 years. 72 individuals were men (46.75%) and 82 women (53.25%). The general prevalence of PONV was 40.9% (63 cases). A higher prevalence of nausea and vomiting in women was observed (*Chi* Square test, p=0.03). Moreover, there was an inverse association between PONV and body mass index (BMI), whereas a higher BMI would correspond to a lower risk of nausea and vomiting (Spearman correlation, p <0.05). There was no association between surgical or anesthetic technique and the score of PONV scale (Spearman correlation, p> 0.05). When performed the comparison of PONV scale index within different surgical procedure, a worse score was observed in abdominal and urological surgeries when compared to vascular and orthopedic ones (Mann-Whitney test, p = 0.003). Additionally, there was a worse score in patients classified as ASA III and IV (Mann-Whitney test, p = 0.0001). The use of opioids either intravenous or intrathecal was not associated with the occurrence of nausea and vomiting in this sample, according to *Chi* Square Test (p> 0.05).
No drug type (serotonin antagonists, corticosteroids and antihistamine drugs) used as a prophylactic protocol has been associated with lower incidence of nausea and vomiting (*Chi* Square Test, p >0.05).
Conclusion: Patients with ASA ≥ 3, female and those submitted to abdominal and urological surgeries as well as those who underwent surgery with longer duration are more susceptible to postoperative nausea and vomiting, regardless of other factors. The identification of the associated factors related to PONV is an important approach to establish rational

protocols of pharmacological prophylaxis, seeking a higher postoperative comfort with reduction of risks arising from the occurrence of nausea and vomiting.

Keywords: Nausea; Vomiting; Anesthesia; Pharmacotherapy; Postoperative period; Prophylaxis.

INTRODUCTION

Nausea and postoperative vomiting (PONV) are common complications in surgical procedures under anesthesia. It is an unpleasant and distressing experience that can delay recovery and discharge, resulting in reduced patient satisfaction [1]. Their occurrence appears to be related to individual factors and the type of anesthesia and surgical procedure [2, 3].

Besides the negative and unpleasant experience, PONV can lead to several surgical and systemic complications. The emetic event can trigger bleeding, dehiscence of sutures, dehydration, fluid and electrolyte imbalance, and complications of elevated intracranial and intraocular pressure, not forgetting the increased risk of triggering esophageal or airway lesions [4, 5]. PONV can increase the length of hospital stay and post-anesthetic recovery, raise the risk of hospital readmissions for ambulatory surgical procedures and reduce the patient's satisfaction with the service [1, 5, 6]. This way, the occurrence of PONV can result in increased morbidity and mortality and costs for health systems [7].

Despite its importance, the approach and systematic handling of PONV is often neglected in clinical practice. Apfel et al. [8] developed a simplified scoring system for risk assessment and stratification of the occurrence of PONV. This multicenter study identified as risk factors the female gender, occurrence of nausea and vomiting in previous surgeries and use of opioid analgesics after surgery. Even after the identification of these risk factors, there is no clear data on the prevalence in different procedures and possible relationships with the anesthetic-surgical technique. Until recently, there was no instrument which was designed, tested and validated for clinical measurement of the occurrence and intensity of PONV.

In 2010, Wengritzky et al. [9] designed a PONV Intensity Scale which was developed and tested in a general surgical population, with satisfactory validity and reliability. Later, Myles & Wengritzky [10] improved the scale in an abridged version, recently translated and adapted culturally to Portuguese language [11]. This instrument evaluates the prevalence and severity of nausea and vomiting, which allows a more complete characterization of these events. This characterization may be useful in identifying the factors related to the type of surgery and surgical technique as well as anesthetic technique and the pharmacotherapy. This set of information have the potential to provide evidence to set protocols of prophylaxis and treatment of PONV in different clinical situations.

Therefore, this study aimed to evaluate the occurrence and intensity of nausea and vomiting in postoperative period considering the patients' characteristics, type of surgery, anesthetic technique and use of drugs in the trans- operative period.

METHODS

This study was approved by the Ethical in Research Committee of Irmandade da Santa Casa de Londrina – BIOISCAL (Protocol #: 828 / 957-2014).

After presenting the objectives and procedures of the research, the participants signed a free consent form, before the start of data collection.

This study has a cross-sectional and observational design, which was developed in a tertiary hospital (Hospital Irmandade da Santa Casa de Londrina) located in Londrina, Paraná State, Brazil.

The study included 154 adult patients (age over 18 years) from both genders. Patients admitted to the Health System for elective surgery were randomly selected and evaluated after discharge from the post-anesthetic recovery room and sent to inpatient units. The discharge evaluation was based on the criteria Audrete & Kroulik [12].

The study excluded patients who refused to participate as well as individuals referred to the Intensive Care Unit (ICU) who needed mechanical ventilation or presented any severe of life-threatening conditions.

The following patient information was collected from the interview and hospital records: age, sex, body weight, height, anesthetic risk classification (ASA criteria), previous history of nausea and vomiting, use of drugs and antiemetic medication administered in the trans-operative period.

The surgical procedure duration as well as the surgical and the anesthetic technique used were considered as well as the route of administration of opioid drugs used. Data were analyzed within the types of surgeries, to achieve a standardization of experimental conditions. Considering the main procedures executed in the reference hospital, the surgeries were divided into two groups: abdominal and urologic surgeries, orthopedic and vascular surgeries.

Patients were interviewed by the same examiners and the Nausea and Vomiting intensity scale [11] was applied at the 12 and 24-hour period following their surgical procedure. The key features of the scale include the intensity, pattern, and duration of nausea. Any episode during this period was considered and an individual score was calculated using the PONV Intensity Scale [9].

A database was prepared using the Statistical Package for Social Sciences version 18.0 for statistical analysis. A 95% confidence interval and a significance level of 5% ($p < 0.05$) were considered.

We used the Mann-Whitney test to compare the PONV regarding ASA criteria and type of surgeries groups.

Spearman's correlation was used to verify a possible correlation between PONV score and age, gender, surgery duration, surgery or anesthetic technique. *Chi* Square test was used to check a possible association between pharmacotherapy and nausea and vomiting occurrence.

RESULTS

The study included 154 individuals submitted to orthopedic, vascular, abdominal and urological surgeries. The mean age of the study population was 44.24 ± 13.4 years, and the sample was composed of 72 men (46.75%) and 82 women (53.25%). Regarding ASA, most patients were classified as ASA I and II (113 cases, 73.4%) and ASA III or IV (41 patients, 26.6%). The occurrence of nausea and vomiting in the global surgical population was 40.9% (63 cases). Considering the gender, 36 women (50.0%) have reported PONV, a higher prevalence when compared to 27 men (32.9%), according to *Chi* Square Test (4.62, p=0.03).

There was an inverse association between PONV with body mass index (BMI), where a higher BMI would correspond to a lower risk of nausea and vomiting (Spearman correlation, p <0.05). Additionally, there was no association between surgical technique (conventional or laparoscopic) or anesthetic technique (general and/or regional anesthesia) and the score of PONV scale (Spearman correlation, p> 0.05). On the other hand, a positive correlation with the surgery duration and PONV was observed (Spearman correlation, p<0.05). Data regarding the described correlations is shown in table 2.

When performed the comparison of PONV scale index, there was worse score in patients submitted to abdominal or urological surgeries (Mann-Whitney test, p = 0.003, Figure 1), when compared to individuals from vascular and orthopedic surgeries. Additionally, a worse score was observed in patients classified as ASA III and IV (Mann-Whitney test, p = 0.001, Figure 2).

The use of opioids either intravenous as intrathecal was not associated with the occurrence of nausea and vomiting in this sample, according to *Chi* Square test (p> 0.05).

It was not found changes at the nausea and vomiting' incidence after the use of serotonin or histamine antagonists as well as the use of corticosteroids at a prophylactic protocol (*Chi* Square test, p >0.05, Table 3).

Table 1 – General characteristics of the study population.

General features	
Age (Mean ± SD)	44.2 ± 13.4
BMI (Mean ± SD)	33.6 ± 14.8
Gender (n, %)	
Female	82 (53.3%)
Male	72 (46.7%)
ASA classification (n,%)	
ASA I and II	113 (73.4%)
ASA III and IV	41 (26.6%)
Surgical duration (Median ± IR, min.)	105 ± 40

SD: Standard Deviation; IR: Interquartile Range.

Table 2 - Correlation between anthropometric and surgical variables with the score of nausea and vomiting.

Variables	Correlation coefficient (rS)	p
Age	- 0.10	0.32
BMI	- 0.29	0.005*
Surgery Duration	+ 0.21	0.04*
Surgical Technique	- 0.02	0.84
Anesthetic Technique	- 0.09	0.42

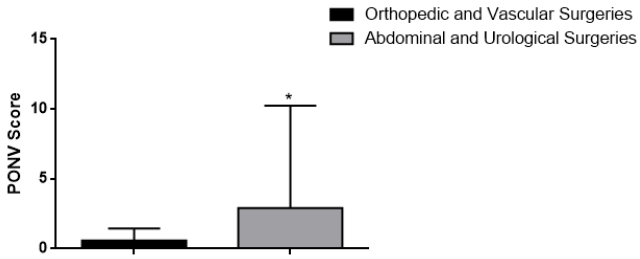

Figure 1 - Postoperative nausea and vomiting (PONV) in relation to the type of surgeries. * Statistical different, Mann-Whitney Test, p=0.003.

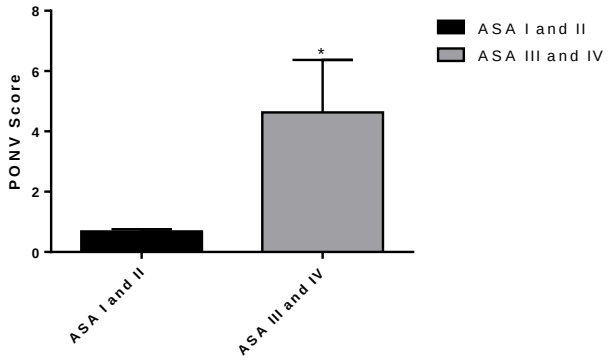

Figure 2 - Postoperative nausea and vomiting (PONV) in relation to the type of surgeries. * Statistical different, Mann-Whitney Test, p=0.003.

Table 3 – Association between classes of antiemetic drugs used and the occurrence of nausea and vomiting.

VARIABLES	NAUSEA AND VOMITING			p
	No	Yes	Total	
Use of Spinal Opiods				
No	55 (66.3%)	28 (33.7%)	83 (100.0%)	0.07
Yes	36 (50.7%)	35 (49.3%)	71 (100.0%)	
Prophylactic use of Serotonin Antagonists				
No	36 (67.6%)	17 (32.1%)	53 (100.0%)	0.11
Yes	55 (54.5%)	46 (45.5%)	101 (100.0%)	
Prophylactic use of Histamine Antagonists				
No	70 (60.9%)	45 (39.1%)	115 (100.0%)	0.44
Yes	21 (53.8%)	18 (46.2%)	39 (100.0%)	
Prophylactic use of Corticosteroids				
No	58 (57.4%)	42 (42.6%)	101 (100.0%)	0.56
Yes	33 (62.3%)	20 (37.7%)	53 (100.0%)	

DISCUSSION

The occurrence of nausea and postoperative vomiting (PONV) is a frequent event that causes nuisance and discomfort to the patient. Moreover, it has the potential to result in complications of the surgical procedure, in addition to extending the hospital stay with consequent increased costs for health system [7,13].

Our results showed that the overall rate of PONV occurring in the hospital was approximately 40.9%. Several studies have reported that an average estimate of this event was 20 to 30% [14]. This prevalence somewhat higher than expected may be because the study was conducted in a tertiary hospital, where more complex procedures and higher comorbidity rates are observed amongst the patients. In addition, the evaluation was conducted in a period of 24 hours after the surgical procedure, which would have the potential for further notification, as many studies perform data collection in a period between 6 and 12 hours.

The prevalence of PONV was significantly higher in the surgery of the digestive tract and in the urological compared to peripheral vascular and orthopedic procedures. This can be explained by the surgical approach to the pelvis and abdominal cavity, with greater potential for gastrointestinal disorders such as *ileus*, which would lead to a higher incidence of emetic events. There was also in this group, higher scores of the scale, indicating a higher intensity of symptoms when compared to the group of orthopedic and vascular surgeries. This observation reinforces the need of specific prophylactic protocol for this population.

Regarding the characteristics of patients, individuals classified as ASA III or IV are more prone to PONV compared to individuals ASA I and II, which may result not only in the worst physical condition and presence of co-morbidities, but also indirectly, the greater complexity of the surgical procedures to which the most severe patients may be undergoing [15, 16].

The prophylaxis protocol with the use of several classes of drugs and distinct mechanisms of action did not result in reducing the incidence of emetic events in this study. PONV prophylaxis is economically beneficial for the hospital when a rational multimodal program is implemented based on patient and procedural risk factors. In fact, extensive use of prophylactic medication indiscriminately has not demonstrated satisfactory effects, especially when considering the costs and the possible adverse effects arising from the use of drugs [16-18].

Therefore, the prevention of PONV should be tailored to the patient's risk-score to avoid side effects and unnecessary costs related to administration of multiple antiemetic drugs without considering their risk [19,20].

The etiology of emesis in surgical patients is multifactorial, and individual factors (female, body mass index) as well as related to the anesthetic-surgical technique (laparoscopic procedures, use of opioids) were associated with an increased risk of occurrence of the event [21]. Despite the efforts to establish a protocol to address this problem with the development of some indexes and scores [22], there is no satisfactory standardization of handling the surgical patient in reducing the incidence of PONV. The emergence of new tools to evaluate the incidence and intensity of emetic events can lead to a better characterization that can serve as a reference for the clinical management.

Thus, this study highlights the importance of expanding the sample to confirm these results as well as the development of protocols for prevention of nausea and vomiting especially in abdominal and urological surgeries.

It can be concluded that ASA patients ≥ 3, female and those submitted to abdominal and urological surgeries as well as those who underwent surgery with longer duration are more susceptible to postoperative nausea and vomiting, regardless of other factors.

Different strategies could be used for these groups of individuals seeking a higher postoperative comfort with reduction of risks arising from the occurrence of nausea and vomiting.

Although PONV management have improved in recent years, it still often occurs in high risk' groups.

Although some prophylactic protocols have been previously described, in some hospital scenarios there is a lack of specific protocols to prevent nausea and vomiting considering different patients' profile, types of surgical procedures and anesthetic drugs combination.

Despite the limited literature data and the variations in the identification of risk factors, the recommendations set for adults could be extrapolated with caution to children. However, further studies are necessary to confirm this hypothesis. On the other hand, it should be recalled that the existence of these evidence does not eliminate the need of individual analysis and their adaptation different population and clinical settings.

Considering that PONV has a complex and multifactorial etiology, the characterization of factors

involved in its genesis is relevant, helping to establish more effective protocols of pharmacological prophylaxis. Despite the benefits of antiemetic medication, these drugs have potential adverse effects and, therefore, their rational use is mandatory.

REFERENCES

[1] Kovac AL. Update on the management of postoperative nausea and vomiting. Drugs 2013; 73: 1525-47.

[2] Öbrink E, Jildenstål P, Oddby E et al. Post-operative nausea and vomiting: Update on predicting the probability and ways to minimize its occurrence, with focus on ambulatory surgery. Int J Surg. 2015; 15: 100–6.

[3] Veiga-Gil L, Pueyo J, López-Olaondo L: Postoperative Nausea and Vomiting: Physiopathology, Risk Factors, Prophylaxis and Treatment. Rev Esp Anestesiol Reanim. 2017; 64(4): 223–32.

[4] McGrath B, Chung F. Postoperative recovery and discharge. Anesthesiol Clin North America 2003; 21 (2): 367-386.

[5] Ku CM, Ong BC. Postoperative nausea and vomiting: a review of current literature. Singapore Med. J. 2003; 44: 366-374.

[6] Eberhart LH, Morin AM, Wulf H et al. Patient preferences for immediate postoperative recovery. Brit. J. Anesthsiol 2002; 89: 760-1.

[7] Parra-Sanchez I, Abdallah R, You J et al. A time-motion economic analysis of postoperative nausea and vomiting in ambulatory surgery. Can J Anaesth 2012; 59 (4): 366-75.

[8] Apfel CC, Laara E, Koivuranta MD et al. A risk simplified risk score for predicting postoperative nausea and vomiting: conclusions from cross-validation between two centers. Anesthesiol 1999; 91: 693-700.

[9] Wengritzky R, Mettho T, Myles PS, Burke J, Kakos A. Development and validation of a postoperative nausea and vomiting intensity scale. Br J Anaesth 2010; 104(2): 158-66.

[10] Myles PS, Wengritzky R. Simplified postoperative nausea and vomiting impact scale for audit and post-discharge review. Br J Anaesth 2012; 108(3): 423-9.

[11] Dalila V, Pereira H, Moreno C, Martinho C, Santos C, Abelha FJ. Postoperative nausea and vomiting: validation of the portuguese version of the postoperative nausea and vomiting intensity score. Rev. Bras. Anestesiol 2013; 63(4): 340-6.

[12] Aldrete JA. The post-anesthesia recovery score revisited. Journal Clinical Anesthesia 1995; 96(7): 89-91.

[13] Cortes-Flores AO, Jimenez-Tornero J, Morgan-Villela G, et al. 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. Eur J Cancer Care 2018; 27: e12686.

[14] Elvir-Lazo OL, White PF, Yumul R, Cruz-Eng H. Management strategies for the treatment and prevention of postoperative/postdischarge nausea and vomiting: an updated review. Zhen Ci Yan Jiu. 2020; 45(11): 920-2. Doi: 10.13702/j.1000-0607.200060.

[15] Sinclair DR, Chung F, Mezei G. Can postoperative nausea and vomiting be predicted? Anesthesiology 1999; 91: 109-18.

[16] Gan TJ, Meyer TA, Apfel CC et al. Society for Ambulatory Anesthesia guidelines for the management of postoperative nausea and vomiting. Anesth Analg. 2007; 105(6): 1615-28.

[17] Cao X, White PF, Ma H. An update on the management of postoperative nausea and vomiting. J Anesth. 2017; 31(4): 617–26.

[18] Yoo JH, Jeon IS, Chung JW, Ryoo JH, You GW, Kim SI. Comparison of palonosetron and ondansetron to prevent postoperative nausea and vomiting in women using intravenous patient-controlled analgesia. Anesth Pain Med 2020; 15: 28-34.

[19] Smith CA, Ruth-Sahd L. Reducing the Incidence of Postoperative Nausea and Vomiting Begins With Risk Screening: An Evaluation of the Evidence. J Perianesth Nurs. 2016; 31(2): 158–71.

[20] Wiesmann T, Kranke P, Eberhart L. Postoperative nausea and vomiting - a narrative review of pathophysiology, pharmacotherapy and clinical management strategies. Expert Opin Pharmacother. 2015; 16(7): 1069–77.

[21] Gan TJ, Diemunsch P, Habib AS, Kovac A, Kranke P, Meyer TA et al. Consensus guidelines for the management of postoperative nausea and vomiting. Anesth Analg 2014; 118: 85-113.

[22] Apfel CC, Korttila K, Abdalla M, Kerger H, Turan A, Vedder I, Zernak C, Danner K, Jokela R, Pocock SJ, Trenkler S, Kredel M, Biedler A, Sessler DI, Roewer N. A factorial trial of six interventions for the prevention of postoperative nausea and vomiting. N Engl J Med 2004; 350(24): 2441-51. doi: 10.1056/NEJMoa032196.