

# Postoperative nausea and vomiting (PONV) in outpatient repair of inguinal hernia



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Piergaspare Palumbo\*, Sofia Usai\*\*, Chiara Amatucci\*, Valentina Taurisano Pulli\*\*, Giulio Illuminati\*, Francesco Vietri\*, Guglielmo Tellan\*\*

\*Department of Surgical Sciences, "Sapienza" University of Rome, Rome, Italy

\*\*Department of Emergency, Anesthesia and Critical Care, "Sapienza" University of Rome, Rome, Italy

## Postoperative nausea and vomiting (PONV) in outpatient repair of inguinal hernia

**PURPOSE:** Nausea and vomiting are among the most frequent complications following anesthesia and surgery. Due to anesthesia seems to be primarily responsible for post operative nausea and vomiting (PONV) in Day Surgery facilities, the aim of the study is to evaluate how different methods of anesthesia could modify the onset of postoperative nausea and vomiting in a population of patients undergoing inguinal hernia repair.

**METHODS:** Ninehundredten patients, aged between 18 and 87 years, underwent open inguinal hernia repair. The PONV risk has been assessed according to Apfel Score. Local anesthetic infiltration, performed by the surgeon in any cases, has been supported by and analgo-sedation with Remifentanyl in 740 patients; Fentanyl was used in 96 cases and the last 74 underwent deep sedation with Propofol.

**RESULTS:** Among the 910 patients who underwent inguinal hernia repair, PONV occurred in 68 patients (7.5%). Among patients presenting PONV, 29 received Remifentanyl, whereas 39 received Fentanyl. In the group of patients receiving Propofol, no one presented PONV. This difference is statistically significant ( $p < .01$ ). Moreover, only 50 patients of the total sample received antiemetic prophylaxis, and amongst these, PONV occurred in 3 subjects.

**CONCLUSIONS:** Compared to Remifentanyl, Fentanyl has a major influence in causing PONV. Nonetheless, an appropriate antiemetic prophylaxis can significantly reduce this undesirable complication.

**Key words:** Day Surgery, Fentanyl, Inguinal, Hernia repair, Nausea, Vomiting

## Introduction

Nausea and vomiting are among the most frequent complications following anesthesia and surgery, so that a significant percentage of patients, from 20 to 30% according to data in the literature, continues to complain of nausea with or without vomiting during the postopera-

tive period<sup>1</sup>. The incidence of PONV (Post Operative Nausea and Vomiting) seems to be less frequent in patients undergoing procedures in "Day Surgery (DS)", probably because of less invasive surgery with lower access to the abdominal cavity. However, the occurrence of PONV in patients in Day Surgery facilities is one of the main reasons of readmission to the hospital, ruling also the failure of the entire Day Surgery path<sup>2</sup>. Anesthesia seems to be primarily responsible for PONV; what appears as a side effect of anesthesia and surgery has become a heavy burden in management of patients during or following a surgical procedure and could become a dominant component of the clinical picture, adversely influencing prognosis and costs. The aim of this study is to observe how different types of anesthe-

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Correspondence to: Prof. Piergaspare Palumbo, Department of Surgical Sciences "Sapienza", University of Rome, Viale del Policlinico, 155 00161, Roma ORCID n. 0000-0002-3295-4170 (e-mail: piergaspare.palumbo@uniroma1.it)

sia could have influence on the onset of postoperative nausea and vomiting in a population of patients undergoing inguinal hernia repair. The primary endpoint of this study is to find a correlation between the anesthetic technique used and the onset of PONV, identifying the changes and the additions to the anesthetic techniques and procedures used in the DS in order to reduce PONV. The secondary endpoint is the management of PONV in Day Surgery facilities.

## Materials and Methods

From January 1st, 2012 to December 31st, 2016, 910 patients, 738 men, with an age range of 18 to 87 years, underwent open inguinal hernia repair and mesh fixation with fibrin glue<sup>3,4</sup>, at the Department of Surgical Sciences, Umberto I Hospital, University of Rome "La Sapienza". The study was approved by the institutional committee and informed consent was obtained by all patients. The selection criteria were those used to select suitable patients for Day Surgery, according to the criteria established by the American Society of Anesthesiologist (ASA). The exclusion criteria were the belonging to ASA IV class, high risk of malignant hyperthermia, severe obesity (BMI > 35), decompensated insulin-dependent diabetes, poorly controlled epilepsy, severe allergies to local anesthetics or other drugs, lack of assistance and supervision once the patients return home. Among the non-enrolled patients, there were also those who showed an inability to understand the methods of treatment, and consequently to accept the treatment program, and patients dedicated to the use of active substances on the CNS (chronic alcoholics and drug addicted). All patients were classified according to the Apfel Score<sup>5</sup>; a score ranging between 0 and 1 is indicative of Low Risk, a score equal to 2 indicates Moderate Risk and a score ranging from 3 to 4 denotes a High Risk. In order to evaluate preoperative anxiety and prevent the risk of PONV frequently associated with it, the APAIS test<sup>6</sup> (the Amsterdam Preoperative Anxiety and Information Scale) was used. The answers given by patients were evaluated with the test parameters, using a five-points scale ranging from 1 (not at all) to 5 (extremely). With regard to surgery the following variables were recorded: type of intervention, duration of intervention, medication and anesthetic technique used, postoperative analgesia, antiemetic prophylaxis, gastric protection. The day fixed for the intervention patients were prepared and monitored according to the protocols routinely used and with the Day Surgery guidelines. The patients were given drugs and fluids through peripheral venous access. As premedication, about 20 minutes before surgery patients received a bolus injection of Midazolam 1-2mg. With regard to the anesthetic technique, a combination of local anesthetic infiltration and analgesodation with Remifentanyl (monitored anesthesia

care, at a dosage of 10µg/kg /minute) was performed in 740 patients (81.41%); the combination of local anesthetic infiltration and Fentanyl was used in 96 patients (10.49%); 74 patients (8.10%) underwent deep sedation with Propofol (1.52mg/kg in bolus, followed by continuous infusion with a dosage of 10µg/kg/h) and local anesthetic infiltration, because of poor compliance to awake surgery.

The use of powerful drugs such as opioids could be associated with an increased risk of ventilatory depression, which requires a careful respiratory monitoring and any supplemental oxygen, usually provided through simple respiratory supports (nasal cannula, VentiMask). During the intervention, a standard monitoring was performed, recording continuously until the end of the surgical procedure ECG, heart rate (HR), non-invasive blood pressure (NIBP), Peripheral Oxygen Saturation (SpO<sub>2</sub>) and End-Tidal CO<sub>2</sub> (EtCO<sub>2</sub>). Patients received a water supply in order to correct preoperative fasting: crystalloid solutions were infused, except in case of hemodynamic changes that required the administration of colloids. Even in the post-operative period, the appropriate hydration of patients was ensured, in the belief that gastrointestinal disorders leading to nausea and vomiting could origin from postoperative dehydration<sup>7</sup>. All the patients received Acetaminophen, administered intravenously at a dose of 15 mg/kg, 30 minutes before the end of the intervention. The antiemetic prophylaxis was performed only in the patients with at least 2 risk factors and it was carried out 15-20 minutes before the end of the intervention by the intravenous administration of Ondansetron. In particular, Ondansetron 4mg was administered in Moderate Risk patients, whereas High Risk patients received Ondansetron 4mg and Dexamethasone 4.8mg (5mg)<sup>8,9</sup>. At the end of the surgical procedure, a modified Aldrete's scoring system were used, in order to determine whether the patients were ready to leave the post-anesthesia care unit. The evaluation of the patient with regard to the onset of PONV was repeated at 2 hours (T0), 4 hours (T1) and finally at 24 hours (T2) from the end of the surgical procedure. After discharge from the Department of DS, patients were monitored via telephone controls, performed 24 hours after surgery, and through a series of surgical controls, the first of which occurred at 48 hours. The evaluation of patient in the postoperative period not only considered nausea and vomiting, but also other parameters such as fever, walking, feeding, pain and possible use of analgesics, surgical wound bleeding, voiding, evacuation, sleep and anxiety. If either one of these parameters is seriously undetermined, hospitalization or re-admission of the patient are recommended, with consequent failure of the route in DS. Post Anesthesia Discharge Scoring System (PADSS)<sup>10,11,12</sup> was used in order to evaluate the patients and to assess the discharge. This evaluation system is based on 6 parameters: vital signs (blood pressure, heart rate, respiratory rate and tem-

perature), gait and mental status, pain, nausea, vomiting, bleeding and voiding. Each parameter can be rated with the assignment of a value from 0 to 2; the sum of these values determines a score ranging from 0 to 12. For a safe discharge, the score must be greater than 9. PADSS is also useful to test the possible need for further administration of antiemetic doses.

## Results

Among the 910 patients who underwent inguinal hernia repair, PONV occurred in 68 patients (7.5%) (Table I). In this group, 63 patients, accounting for 92.65%, showed nausea and vomiting after 24 hours from the end of surgical procedure (T2), following the discharge from the Department of DS, and in this case the PONV episode should be better described as PDNV (Post Discharge Nausea and Vomiting). In a limited group of subjects composed by 3 patients, 4.41% of the entire sample of patients with PONV, episodes of PONV occurred 4 hours after surgery (T1). 2 patients, representing 2.94% of patients with PONV, presented repeated episodes of nausea and vomiting from 4 to 24 hours after surgery. PONV occurred in no patients at 2 hours after surgery (T0) (Table II). Only 50 patients of the total sample received antiemetic prophylaxis, representing 5.51% of the entire population, and amongst these, PONV occurred in 3 subjects. This suggests that 95.59% of patients (65 patients) with PONV didn't receive antiemetic prophylaxis, whereas 4.41% of them (3 patients) did. Concerning the total sample, these proportions are respectively 7.14% and 0.33%. The relative percentages of PONV in these techniques were:

– MAC with Remifentanyl and infiltrative local anesthesia: 42.65% (29 patients);

– combination of infiltrative local anesthesia and Fentanyl: 57.35% (39 patients);

– combination of infiltrative local anesthesia and Propofol: 0%.

There were no readmissions due to episodes of PONV or complications.

## Discussion

The importance of PONV couldn't and shouldn't be underestimated, especially in Day Surgery, created to minimize the stress associated with surgical procedures. In this regard, it is important to bear in mind that the entire course of treatment, the evaluation of the patient, the recognition and treatment of anxiety, the anesthesia and the surgical procedure are essential, with the aim of providing an appropriate and effective prophylaxis and ensuring the correct management of PONV<sup>13</sup>. The use of these anesthetic techniques for inguinal hernia repair is safe and poorly affected from nausea and vomiting. However, PONV can represent a real problem to a quick discharge. The sample can be considered valid, as it is a fairly reliable cross-section of the typical population undergoing surgery in the DS facilities, both in terms of clinical parameters (ASA risk class), and in terms of population (age and gender distribution). The wide age range of patients and its standard deviation (18-87 years  $\pm$  16.7) show a remarkable heterogeneity of the study population, with the variety of diseases related to it. Women, without significant differences in age, reveal an increased susceptibility to PONV syndrome, as generally more anxious because of the hormonal changes they face during the menstrual cycle<sup>14</sup>. In confirmation of this, the female gender is considered as a risk factor in the Apfel Score. In this survey, women who experienced

TABLE I - Incidence of PONV (including PDNV, Post Discharge Nausea and Vomiting) in the population of patients who underwent inguinal hernia repair.

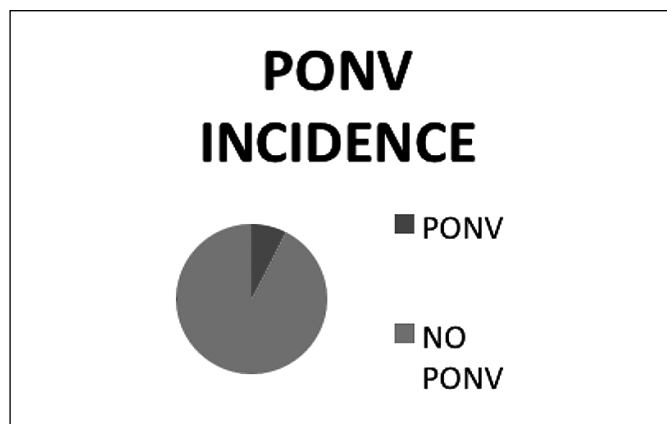
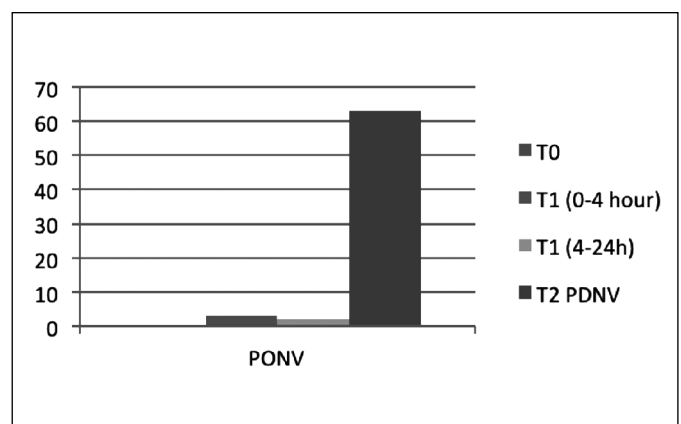


TABLE II - Incidence of PONV in four different evaluation times: T0 (end of surgery), T1a (0-4 hours after surgery), T1b (4-24 hours), T2 (PDNV, Post Discharge Nausea and Vomiting).



PONV represent 20.93% (36 of all 172 female patients in the sample), while the men represent 4.34% (32 of all 738 male patients in the sample). These data show that women are more frequently affected by symptoms of PONV; therefore, women who undergo a surgical procedure should be treated with greater care to prevent postoperative nausea and vomiting. Of the 910 patients enrolled, PONV occurred in only 68 subjects, representing 7.47% of the total sample. The low incidence of PONV in ambulatory and day surgery seems to be the result of the best anesthetic technique choice (local and regional rather than general anesthesia), the balanced drugs employment<sup>15</sup> and of the less invasive procedures, which require shorter intervention times, less abdominal tissues handling and mechanical stimulation of the peritoneum<sup>5,16</sup>. The diffusion of these procedures would seem to contribute to the reduction of the PONV, reducing the duration and intensity of the surgical and anesthetic insult.

The onset of PONV appears to be affected also by the anesthetic technique used and by the administration of analgesics to patients belonging to different classes. In the group of patients who received MAC with Remifentanyl, 29 subjects had postoperative nausea and vomiting, representing 42.65% of all the patients affected by nausea and vomiting, 3.92% of patients who underwent MAC with Remifentanyl and 3.18% of the total sample. In the group of patients who received Fentanyl, 39 subjects had postoperative nausea and vomiting, representing 57.35% of the patients with PONV, 40.63% of patients who underwent anesthesia with Fentanyl and 4.29% of the total sample.

In the group of patients who underwent anesthesia with Propofol, no one had PONV. The complete absence of PONV in this group could be related to the antiemetic activity of this drug which has proved to reduced this undesirable phenomenon<sup>17-19</sup>. Unfortunately, according to the European Guidelines, the Propofol induced anesthesia is a more invasive technique and could be reserved only to selected cases.

These percentages can show how the onset of PONV is related to the opioid analgesics and this finding is in line with the results reported by several scientific papers on the most emetic effect of this class of drugs compared to other analgesics used<sup>20-22</sup>. Considering each group, PONV occurred in a percentage of 3.92% in Remifentanyl group and in a percentage of 40.63% in Fentanyl group; with regard to the total sample, these percentages are respectively 3.18% and 4.29%, showing not a great difference, but statistically significant ( $p$  value  $< .01$ ). This latter evaluation takes into account the possible bias deriving from the different size of the two groups. Moreover, since the patients of both groups underwent surgery with superposable procedures, the only variables that could have affected their outcome causing the onset of PONV are the opioid drugs received during the anesthesia and their PONV risk.

Short-acting opioids have often been held responsible as a major cause of postoperative nausea and vomiting in Day Surgery patients<sup>20,23,24</sup>. Obviously, the amount of opioid administered seems to affect the incidence of PONV, in line with other studies that found a strong correlation between dose and incidence of PONV<sup>25,26</sup>. However, in our experience, looking at each specific group, PONV occurred in a percentage of 40.63% in Fentanyl group versus 3.92% in Remifentanyl group as mentioned above: this could be representative of a major influence of Fentanyl in causing this effect, confirming that there is a bigger risk of PONV using Fentanyl compared to Remifentanyl.

The secondary endpoint of this study is represented by the management of PONV, considering that the best strategy is the prevention of this complication, through a careful selection of the patients and an accurate evaluation of the candidates for the DS path, is paying particular attention to all predisposing factors<sup>27</sup>. The screening of patients carried out during the preoperative anesthesia visit is useful not only to identify the risk of PONV in each subject, but also to quantify the amount of this risk. The current study has shown that PONV would seem to be influenced by the administration of antiemetics prophylaxis<sup>13</sup>. This is demonstrated by the incidence of PONV significantly lower in patients who received prophylaxis (0.33%), compared to subjects who didn't received it (7.14%,  $p$  value  $< .01$ ). These results agree well with the bibliography<sup>24</sup> and they are lower than those reported in the literature<sup>28</sup>. The prophylaxis was diversified according to the Apfel score and to the relative risk classes; in the high risk patients a multimodal approach was chosen, administering two antiemetics agents belonging to different classes, with complementary actions. Despite this procedure has been applied, PONV occurred in 3 patients who received antiemetic prophylaxis in the Fentanyl group. In the management of this undesirable complication, patients were treated in different ways: those who didn't receive antiemetics prophylaxis were treated with the administration of Ondansetron 1mg or Dexamethasone 8mg<sup>[29]</sup>; Metoclopramide 10mg was administered to the subjects who were given antiemetic treatment<sup>30</sup>.

## Conclusions

In view of the most common incidence of PDNV compared to PONV, patients should be informed and trained to assume, even after discharge, Metoclopramide at the early evidence of nausea.

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

## Riassunto

Nausea e vomito sono tra le più frequenti complicazioni a seguito di interventi chirurgici anche nella Day Surgery. Poiché l'anestesia rappresenta specificamente la causa principale di PONV, l'obiettivo dello studio è quello di valutare in quale modo i differenti tipi di anestesia possano modificare l'insorgenza di nausea e vomito postoperatori in pazienti sottoposti ad intervento di ernioplastica inguinale.

910 pazienti di età compresa tra 18 e 87 anni, sono stati sottoposti ad ernioplastica inguinale per via inguinotomica. Il rischio di PONV è stato calcolato per ogni paziente in base all'Apfel Score.

L'infiltrazione di anestetico locale effettuata in ogni intervento, è stata associata ad analgesedazione con Remifentanil (740 pazienti), alla somministrazione di Fentanyl (96 pazienti) ed, infine, a sedazione profonda con Propofol (74 pazienti).

Tra i 910 pazienti sottoposti ad ernioplastica inguinale, il vomito e nausea postoperatori si sono manifestati in 68 casi (7.5%). Tra questi, 29 erano stati trattati con Remifentanil, mentre 39 con Fentanyl. Nel gruppo di pazienti trattati con Propofol, nessuno ha manifestato PONV. Questa differenza risulta statisticamente significativa ( $p < .01$ ). Inoltre, solo 50 pazienti globalmente hanno ricevuto profilassi antiemetica, e di questi, solo 3 hanno manifestato PONV.

Rispetto al Remifentanil, il Fentanyl si è rivelato avere una più spiccata capacità emetigena. Tuttavia, una appropriata profilassi antiemetica può ridurre significativamente l'insorgenza di questa invalidante complicanza.

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