

# The Assessment of Risk Factors for Postoperative Nausea and Vomiting

Sadqa Aftab<sup>1</sup>, Abdul Bari Khan<sup>2</sup> and Ghulam Raza<sup>1</sup>

## ABSTRACT

**Objective:** To determine the risk factors for postoperative nausea and vomiting.

**Study Design:** Quasi-experimental study with prospective data collection.

**Place and Duration of Study:** The study was conducted at Dow Medical College University and Civil Hospital, Karachi from January to December 2004.

**Patients and Methods:** Data on patients' characteristic, anesthesia, surgery and postoperative nausea and vomiting was collected in operating theatre, postanesthesia care unit and wards.

**Results:** During postoperative 24 hours period, 60 out of a total of 200 patients experienced nausea and vomiting. The factors associated with an increased risk of Postoperative Nausea and Vomiting (PONV) were gender (female odds ratio 3), patients with previous history of nausea and vomiting or motion sickness (odds ratio 4), laparoscopic cholecystectomy (odds ratio 3.5) and eye surgery (odds ratio 3.9), all of these were statistically significant ( $p < 0.05$ ). No statistically significant difference was found between the other parameters.

**Conclusion:** The incidence of PONV was found significantly higher in female gender, patients with previous history of nausea and vomiting or motion sickness, patient undergoing laparoscopic cholecystectomy and eye surgery.

**Key words:** Postoperative nausea. Vomiting. Predictive factors. Anaesthesia.

## INTRODUCTION

Life-threatening complications associated with anesthesia have become very rare, safety records have encouraged anesthetists to focus on minor morbidity. Of these symptoms, postoperative nausea and vomiting (PONV) is the 'big little problem' as it decreases satisfaction and results in distressing complications, like pain, hematoma and wound dehiscence. PONV is not only unpleasant to patient but increases the risk of aspiration pneumonia, if there is delayed recovery of normal airway reflexes in postoperative period. PONV increases the use of resources, including medical and nursing care, intravenous fluids, drugs and other supplies.<sup>1</sup>

Recent review of literature has reported that the incidence of postoperative nausea and vomiting is 20-30% with little improvement in recent years. Incidence may be higher because of the influence of pre-operative characteristic, factors related to operation and anesthesia, and the intensity of pain and its management in postoperative period.

The problem of postoperative nausea and vomiting is thought to be multifactorial and some of the predisposing patient characteristic, which have been

associated with an increased prevalence of postoperative nausea vomiting are age, gender, obesity, history of previous postoperative nausea and vomiting or motion sickness.

Peri-operative factors that have been associated include recent food ingestion, surgical site, duration of procedure, pain, state of hydration and gastrointestinal dysfunction.<sup>2</sup>

Example of high risk surgical sites for PONV includes laparoscopic surgery, gynecological, genitourinary and otorhinolaryngological procedures. Anesthetic factors include pre-anesthetic medications, choice of anesthesia, and use of opioids. General anesthesia is associated with the higher incidence of postoperative nausea and vomiting than regional.<sup>3</sup>

The degree to which these factors are predictor of postoperative nausea and vomiting remain unknown, objective of this study was to determine the risk factors for postoperative nausea and vomiting.

## PATIENTS AND METHODS

After approval of the institutional ethical committee and obtaining informed consent from patients, 200 adults, ASA 1 patients, scheduled for elective surgeries under general or intrathecal anesthesia, were studied.

This study was done on patients aged between 18 to 79 years, BMI between  $> 15 \text{ kg/m}^2$  and  $< 40 \text{ kg/m}^2$ , with hospital stay greater than 24 hours. Exclusion criteria for this study were pregnancy, drug abuse, impairment of bowel motility and presence of comorbid.

*Department of Anaesthesiology<sup>1</sup>/Cardiac Surgery<sup>2</sup>,  
Dow University of Health Sciences, Karachi.*

**Correspondence:** Dr. Sadqa Aftab, B/70, Block-L,  
North Nazimabad, Karachi.

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Selection of patients was done prospectively by random sampling procedure, which can be expected to yield results directly representative of target population in hospital.

Population included elective procedure from five surgical units, ophthalmology, otorhinolaryngology, gynecology, orthopedic and general surgery. Study was conducted between January to December 2004.

Pre-operative patient characteristic and intra-operative variable were documented on specifically designed proforma by same anesthetist, who was involved in anesthetic management of all patients. Data on demographic (age, gender, weight and height), smoking status, prior history of motion sickness or postoperative nausea and vomiting, type of surgery, duration of anesthesia, endotracheal intubation or laryngeal mask usage were recorded.

Anesthetic management whether general or regional was at the discretion of anesthetist. In all cases of general anesthesia, induction was performed with Nalbuphine 0.1 mg/kg, Sodium thiopentone 5 mg/kg, and intubation facilitated with Atracurium 0.5 mg/kg, anesthesia was maintained with volatile anesthetic (Halothane). Neuromuscular blockade was reversed with a combination of 50 µg/kg neostigmine and 15 µg/kg atropine. Regional anesthesia cases were performed using intrathecal bupivacaine and patient received midazolam for sedation, if needed.

Patient received standard monitoring of pulse rate, blood pressure, pulse oximetry, level of conscious, respiratory rate and temperature on arrival in recovery, the patients with mild pain received diclofenac and patients with moderate to severe pain received combination of injection diclofenac and nalbuphine, and shifted to ward and same analgesic were continued in postoperative period. Antiemetic administered, if required by duty nurse.

Twenty-four hour later, the patients were seen by same anesthetist and episodes of nausea and vomiting were recorded.

Postoperative emesis was defined as vomiting (an integrated reflex resulting in expulsion of gastric content), retching (a non-productive vomit) or nausea (the sensation of wishing to vomit). Patients were considered nauseated, if they responded to the question "are you or have you felt nauseated since your discharge from recovery area." For same interval, the episode of vomiting was recorded, patient who had either postoperative nausea or postoperative vomiting were considered to have had PONV.<sup>4</sup>

All data were analyzed with SPSS version 10, statistics on patients, surgery and anesthetic characteristic are given in frequency and percentages. Following variables were considered in the analysis: gender (female = 1,

male = 0), age (< 49 years = 1, > 49 years = 0), body mass index (> 30 = 1, < 30 = 0), smoking status (non-smoker = 1, smoker = 0), previous history of nausea vomiting or motion sickness (yes = 1, no = 0), type of anesthesia (general anesthesia = 1, intrathecal anesthesia = 0), duration of operation (< 90 minutes = 0, > 90 minutes=1), type of surgery (eye, ENT, gynecology, general surgery and orthopedic). Significant risk factors were determined by using multinomial logistic regression analysis, taking PONV as dependant variable.

## RESULTS

Of the 200 patients studied, 96 (48%) were female and 104 (52%) male, their ages ranged from 18-79 years.

Overall, 30% experienced postoperative nausea and vomiting (PONV), female had a nearly two-fold high rate of PONV compared to male.

Among patients from 18-49 years, the incidence of PONV was 24%, the incidence decreased to 6% among patients from 49-79 years. The frequency of PONV showed marked decrease with increasing age. PONV occurred in 4 out of 8 patients with previous history of nausea, vomiting or motion sickness. Smokers had 7.5% incidence of PONV compared to non-smokers with 22.5%, similarly, patients with BMI > 30 had 4.5% incidence of PONV compared to patients with BMI < 30 with 25.5% (Table I).

**Table I:** Pre-operative patient's characteristic, number (%) of patients and PONV%.

	No. of patients		Frequency of PONV	
	No.	%	No. and % of PONV within characteristics	% of total PONV
Total	200	100	60(100%)	30%
<b>Patients characteristic</b>				
Age range (yrs)				
18 – 29	82	41	27 (45%)	13.5
30 – 39	35	17.5	11 (18.8%)	5.5
40 – 49	41	20.5	10 (16.7%)	5.0
50 – 59	16	8	6 (10%)	3.0
60 – 69	8	4	3 (5%)	1.5
70 – 79	18	9	3 (5%)	1.5
<b>Gender</b>				
Male	104	52	20 (33.3%)	10.0
Female	96	48	40 (66.7%)	20.0
<b>Smoking status</b>				
Smoker	50	25	15 (25%)	7.5
Non-smoker	150	75	45 (75%)	22.5
<b>History of motion sickness or PONV</b>				
History of motion sickness or PONV	8	4	5 (8.3%)	2.5
No history of motion sickness or PONV	192	96	55 (91.7%)	27.5
<b>BMI</b>				
<30	180	90	51 (85%)	25.5
>30	20	10	9 (15%)	4.5

PONV= postoperative nausea vomiting.

General anaesthesia was given in 69.5% of patients, as compared to 30.5%, who received regional anaesthesia. There was three times increase in the risk of PONV among patients receiving general anaesthesia compared to regional anaesthesia.

PONV occurred in 35 patients who received general anaesthesia with endotracheal intubation as compared to 31 patients anaesthetized with laryngeal mask airway.

Seventy four percent of the procedure lasted 31–90 minutes and frequency of PONV was 17.5% compared to 12.5% among patients with surgery lasting 90–150 minutes.

There was variation in the incidence of PONV according to the type of surgery. Patients undergoing general surgery had the highest incidence (12%) followed by the patients with otorhinolaryngology (6.5%), eye surgery (4.5%). Patients undergoing gynecologic and orthopedic procedure experienced the lowest incidence of PONV i.e. both with 3.5%.

There was, however, wide variation among the different surgical procedures of the same surgical specialties, orthopedic procedures, undergoing upper limb surgeries, experienced two times higher frequency of PONV as compared to lower limb surgeries. PONV in laparoscopic cholecystectomy occurred in 16 patients out of 24 general surgery patients who experienced PONV.

Those undergoing ophthalmologic procedures strabismus surgery had a two-time higher frequency of PONV than did other patients having other ophthalmologic procedures (Table II).

## DISCUSSION

Identifying patients with high baseline risk allows goal directed use of antiemetics that may not be indicated for routine practice, as patient with low risk are unlikely to benefit from antiemetic prophylaxis, rather may lead to unnecessary risk from potential side effects of antiemetic.<sup>5</sup>

Exactly 30% patients in this study i.e. 60 out of 200 experienced PONV, which is similar to other studies with 20-30% incidence.<sup>6</sup> Factors that effect nausea vomiting include female gender, age, body size, anesthetic technique and duration, surgery and use of opioids.<sup>7</sup>

The current study confirms that female (independent type of surgery) experience higher incidence of PONV, 20%, compared to male with 10%, as previous reports supported the difference and attributed the finding to variation in serum gonadotrophin or other hormone levels.

Another predictor of PONV was age. Age decreased the likelihood of PONV by 13% for each 10 years increase, studies described a decreasing incidence among men

**Table II:** Pre-operative characteristic, number of patients and frequency of PONV.

	No. of patients		Frequency of PONV	
	No.	%	No. and % of PONV within characteristics	% of total PONV
Total	200	100	60(100%)	30%
<b>Duration of anaesthesia (minutes)</b>				
>90	90	45	25 (41.7%)	12.5
<90	110	55	35 (58.3%)	17.5
<b>Type of anaesthesia</b>				
General anaesthesia	139	69.5	46 (75.6%)	23.0
Endotracheal intubation	108	54	35 (76.1%)	17.5
Laryngeal mask airway	31	15.5	31 (23.9%)	5.5
Regional anaesthesia	61	30.5	14 (23.3%)	7.0
<b>Surgical procedures</b>				
General surgery (all)	70	35.0	24 (40%)	12.0
Laparoscopic surgery	28	14.0	16 (66.66%)	8.0
Thyroidectomy	5	2.5	-	-
Para umbilical hernia repair	6	3.0	2 (8.33%)	1
Breast lump removal	8	4.0	-	-
Varicose veins	8	4.0	1 (4.16%)	0.5
Anal fissure	4	2.0	1 (4.16%)	0.5
Hemorrhoids	4	2.0	1 (4.16%)	0.5
Pilonidal sinus	5	2.5	3 (12.5%)	1.5
<b>Ophthalmology</b>	15	7.5	9 (15%)	4.5
Strabismus	8	4.0	6 (66.66%)	3.0
Retinal detachment	4	2.0	3 (33.33%)	1.5
Cataract	3	1.5	-	-
<b>Otorhinolaryngology</b>	58	29.0	13 (21.66%)	6.5
Mastoidectomy	5	2.5	6 (46.15%)	3.0
Tonsillectomy	28	14.0	4 (30.76%)	2.0
Septoplasty	25	12.5	3 (23%)	1.5
<b>Gynecological procedure</b>	23	11.5	7 (11.66%)	3.5
Myomectomy	4	2.0	-	-
Vaginal hysterectomy	3	1.5	4 (57.1%)	2.0
Ovarian Cyst	3	1.5	2 (28.57%)	1.0
Uretero vaginal prolapse	6	3.0	1 (11.7%)	0.5
<b>Orthopedic procedure</b>	34	16.0	7 (11.66%)	3.5
Fracture femur	10	5.0	-	-
Fracture humerus	4	2.0	4 (57.14%)	2.0
Fracture tibia/fibula	7	3.5	1 (14.28%)	0.5
Fracture radius	8	4.0	1 (14.28%)	0.5
Knee arthroscopy	5	2.5	1 (14.28%)	0.5

with increasing age and an insignificant decrease among women until eighth decade.<sup>8</sup> In contrast, this study showed a gradual decrease in PONV with increasing age irrespective of sex.

The study did not confirm that obese patient suffered more from PONV, as patient with BMI < 30 experience higher incidence of PONV. Smoking is also a predictor of PONV, as smoking decreased the likelihood of PONV by 34%, the relationship between smoker and PONV was not evident in literature, and our result showed a lower risk of PONV in smokers, 7.5%, as compared to non-smokers with 22.5%, identified smoking as a protective factor against PONV.

Another predictor of PONV is previous history of motion sickness or PONV, which increases likelihood of PONV by three times in the first 24 hours, a study showed previous history of nausea and vomiting as the second strongest predictor of PONV.<sup>8</sup>

It had been suggested that the individual with previous PONV or motion sickness may have a well-developed reflex arc for vomiting.<sup>9</sup> In this study, previous history of nausea and vomiting was present in 8 patients, and out of them, 4 developed PONV, while in patients with no history of nausea and vomiting, 55 out of 192 patients developed PONV.

Anesthetic technique is also a predictor of PONV, patients receiving general anesthesia were approximately 11 times more likely to experience PONV than those receiving regional anesthesia.<sup>10</sup> In this study, patients receiving general anesthesia experienced three times more incidence of PONV, compared to regional anesthesia. Increased incidence of nausea and vomiting with general anesthesia could be related to use of volatile anesthetic with perioperative opioids.<sup>11</sup>

The volume of narcotic may contribute to the incidence of PONV,<sup>7</sup> the incidence of nausea and vomiting reported in literature is 6% in patients who received nalbuphine 0.1 mg/kg without undergoing any surgery.<sup>12</sup>

There is evidence that the emetic effect of opioids are mediated via opioid receptors in the area postrema, irrespective of the route of administration, resulting in activation of the vomiting centre and it has been speculated that by directly activating the vestibular system, opioids increase the sensitivity of the emetic reflex. High doses of opioids were required in general anesthetic techniques, while less doses of opioids were needed in regional technique because of residual analgesia in early postoperative period.<sup>13</sup>

Limitation of this study was that it lacked data on consumption of postoperative opioids. PONV occurred in 35 patients who were intubated, as compared to 31 patients where laryngeal mask airway was used as seen in the presented study.

Intubated patients received balanced anesthesia technique comprising of nalbuphine, thiopentone, atracurium for intubation and maintained by oxygen, nitrous oxide with halothane as volatile anesthetic, while patients who were not intubated and using laryngeal mask were anesthetized with nalbuphine, propofol with oxygen, nitrous oxide and halothane as volatile anesthetic, probably lesser incidence related to propofol, which provided protection against PONV.<sup>14</sup>

Total intravenous anesthesia protects against PONV compared to general anesthesia with volatile anesthetic agents. Because presented result applies to general anesthesia with volatile anesthetic agents, further study is required to determine the predictive power of general anesthesia with intravenous agents.<sup>14</sup>

The duration of anesthesia is another predictor of PONV, increasing the risk for PONV, findings could be related to larger number of potentially emetic drugs administered during long procedures. A study by Sinclair noted that incidence of PONV increased from 2.8% among patients with surgical duration less than 30 minutes to 27.7% among patients with surgery lasting 151-180 minutes.<sup>15</sup> The incidence of PONV with duration less than 90 minutes was 17.5% and 12.5% in procedures lasting 90-150 minutes in the current study.

Type of surgery is a significant predictor of PONV as high incidence of PONV was recorded in laparoscopic surgery in a study.<sup>15</sup> Similar results were recorded in this study, where among general surgery patients, PONV occurred in 16 patients undergoing laparoscopic cholecystectomy, which was statistically significant ( $p < 0.05$ ).

The etiology of PONV in laparoscopic surgery is not fully understood, however, risk factors such as a long period of carbon dioxide insufflations, gallbladder surgery, intra-operative use of volatile anesthetics and female sex may be the contributing factors.<sup>16</sup>

In most studies, ophthalmologic procedures are associated with high frequency of PONV. In this study, ophthalmologic procedures had statistically higher incidence of PONV, related to two-time high frequency of PONV in patients undergoing strabismus surgery as compared to other ophthalmologic procedures, this may be caused by an oculocardiac reflex vagal response triggered by eye muscle manipulation.<sup>15</sup>

A study strongly suggests that volatile anesthetics appear to be the major cause for early postoperative vomiting.<sup>15,17</sup> In this study, among the patients having orthopedic procedure, those undergoing upper limb surgery experienced more nausea and vomiting than those undergoing lower limb surgery, possibly because general anesthesia was administered in upper limb as compared to lower limb surgeries, where regional techniques was preferred, although not being statistically significant. Orthopedic surgery involves bone injury and damage to periosteum, resulting in significant postoperative pain.<sup>18,19</sup> There is evidence that nausea accompanies pain in early postoperative period, which requires opiates and non-steroidal anti-inflammatory analgesics more in patients who have received general anesthesia as compared to regional anesthetic technique, and possibly the reason for higher incidence of PONV in upper limb surgeries.<sup>20</sup>

A limitation of this study was the potential for under reporting of analgesic administration by ward nurses, therefore, further study of an improved effect of postoperative analgesia on the incidence of PONV is needed.

## CONCLUSION

It can be concluded that the incidence of PONV was significantly higher in female patients with history of nausea, vomiting or motion sickness, patients undergoing laparoscopic cholecystectomy and eye surgery.

Knowledge of these risk factors of PONV should increase anesthesiologist's efforts to reduce the incidence of PONV by selecting patients for antiemetic therapy.

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