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Post-operative nausea and vomiting in patients undergoing day-case surgery: an international, observational study

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Abstract

Post-operative nausea and vomiting (PONV) are complications of surgical procedures, and are of particular relevance in the day-case setting. The aim of this study was to examine the incidence and impact of PONV before and after discharge from day surgery units. Patients recorded the incidence, severity and impact of PONV for 5 days following surgery. The incidence of PONV in the 561 eligible patients was 17% upon waking, 14% travelling home and 3% by the 5th day post-surgery. PONV was most common in gastrointestinal, obstetric and gynaecological surgery. Although freedom from pain and PONV are requirements for discharge after ambulatory surgery, PONV is still a problem post-discharge.

Keywords: Post-operative nausea and vomiting; PONV; Day-case surgery; Observational study

1. Introduction

An increasing amount of surgery is being performed on a day-case basis. It not only requires the highest standards of care but also a clear demonstration of the patient's overall readiness for discharge. Furthermore, the types of surgery being performed on a day-case basis are of far greater complexity than might have been thought possible ten years ago. One of the major limiting factors that prevents the early discharge of patients from a day surgery centre is post-operative nausea and vomiting (PONV). Adequate control of PONV, a well-recognised problem in the immediate post-operative phase, has become one of the pre-requisites for patient discharge from day-case surgery. Although several studies have assessed the incidence of PONV in the hospital setting [1–3] comparatively little research has been done to establish the incidence of PONV after the patients' discharge from hospital. In a US pilot study, PONV was reported to occur in 35% of patients over a 5-day period of assessment following discharge from out-patient surgery centres [4]. In a similar study of patients undergoing day-case surgery, more patients experienced PONV after discharge than prior to discharge [5]. Results from a study of post-operative complications in children who had undergone day-case surgery showed that 13% of these patients had PONV at home [6].

PONV occurs in a sizeable proportion of the patients in the immediate post-operative phase but this is not generally a problem while patients remain supervised in the day-case unit and receive anti-emetic medication if required. However, PONV following discharge home may be distressing both for the patient and carers. Post-discharge PONV can have economic consequences for hospitals due to possible hospital re-admission [7] and for general practitioners, who may be contacted by patients seeking treatment for post-operative complications. Humanistic consequences include patient and

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family distress, as well as anxiety if further surgery is ever required. In one study of patients who underwent ambulatory surgery, 71% of patients who reported dissatisfaction with the procedure attributed this to PONV [8]. Patients and their carers may also suffer due to time lost from work and normal activities, while patients may experience delayed recovery and persistence of post-operative complications [9].

The purpose of this study was to examine patients' experiences with PONV both during and after discharge home from day-case surgery centres. The objectives of the study were to determine the incidence of post-discharge PONV, the extent to which the PONV affected normal functioning and daily activities and the use of anti-emetic agents as prophylaxis or treatment for PONV.

2. Methods

2.1. Study design

This international, prospective, observational study was carried out in adults undergoing day-case surgery. Patients provided details of the extent and severity of PONV and pain using a daily diary card, which was completed during the hospital stay and for 4 days following discharge.

Patient details including age, gender and previous history of PONV were recorded by the investigator on a case report form (CRF). Details of the operation, anaesthetic regimen and the overall use of anti-emetic and analgesic agents were also recorded on the CRF. Details of any anti-emetic or analgesic medications prescribed and supplied prior to discharge home were also entered onto the CRF. Delays in discharge due to PONV and whether the patient was readmitted to hospital were also recorded.

Patient diary cards contained information on the severity of nausea (defined as: none, mild, moderate or severe), the distress caused by nausea (defined as not at all, slightly, quite a bit or extreme) and the number of emetic episodes. Patients also recorded pain severity (defined as: none, mild, moderate or severe) and resulting distress (defined as not at all, slightly, quite a bit or extreme) prior to surgery and at pre-determined times post-operatively until arrival home on the day of surgery. Thereafter, the patients completed the diary card before going to bed on the day of the operation and for a further 4 days to record the incidence and grade of nausea, vomiting, pain, utilisation of medication and the impact of their symptoms on time lost from work and normal activities.

The impact of PONV on daily activities was assessed using the following questions: Did nausea or vomiting prevent you from doing your work/normal activities today? How much time did you miss from work/normal activities because of nausea or vomiting?

Healthcare resource utilisation due to PONV was assessed using the following questions: Did a doctor or nurse visit you at home today because of nausea or vomiting? Did you visit your doctor or the clinic today because of nausea or vomiting? Were you admitted to hospital because of your nausea or vomiting? Hospital admission, if yes, how many days?

2.2. Patients

Patients were over 18 years of age, and underwent surgery that did not require hospitalisation or a stay of more than 24 h in the day-case unit. Patients who were illiterate, mentally impaired or unable to follow instructions were excluded. Prophylactic anti-emetic therapy with ondansetron was not permitted. All patients were required to provide written, informed consent and the study was conducted according to the Declaration of Helsinki. Local ethics committee approval was obtained where necessary. The date and time of discharge was recorded by the investigator following delayed discharge or hospitalisation.

2.3. Data analysis

Pre- and post-operative data were reported in the form of frequency distributions. No statistical tests were performed.

3. Results

3.1. Patients

A total of 586 patients were recruited in nine countries: the Czech Republic (17 patients), Egypt (115 patients), Estonia (36 patients), Germany (164 patients), Iceland (76 patients), Italy (11 patients), Norway (23 patients), New Zealand (32 patients) and the UK (112 patients). Of the 586 patients recruited into the study, three were not eligible for inclusion: one was under 18, one was hospitalised for more than 24 h and another was judged unable to complete the diary card. A further 22 patients failed to return their diary cards. Although prophylactic ondansetron was a violation of the protocol the ten patients thus treated were included in the intent to treat population upon which subsequent analyses were performed. All analyses were based on 561 eligible patients. Patient demographics, surgery details and medications received are summarised in Table 1. The majority of patients were anaesthetised using volatile agents (78%) and/or opioid anaesthetics (80%). The median time from admission to completion of surgery was 2.1 h (range: 0.1–9.0 h). The median length

Table 1
Patient demography and surgery details at baseline and anaesthesia and medication administered during the study

	n	%
Number of patients	561	
Sex		
Male	176	31
Female	385	69
Median age (±S.D.) years	37 (14)	
Type of surgery		
General surgery	100	18
Obstetrics and gynaecologic	187	33
Orthopaedic	135	24
Gastrointestinal	44	8
Other/Unknown	95	17
Previous surgery	435	78
Previous PONV	101	18
Medication		
Volatile anaesthetic	435	78
Opioid anaesthetic	449	80
Prophylactic anti-emetic	112	20
Treatment anti-emetic	50	9
Post-operative analgesic	311	55

of stay in the day-case unit was 6.6 h (range: 1.0–31.5 h) and the median duration of stay after the operation was 4.4 h (range: 0.3–29.7 h). Five patients were hospitalised following surgery for reasons other than PONV.

3.2. Nausea and vomiting

Pre-operative nausea and vomiting was reported in 41 patients (7%). This was mild or moderate in the majority (73%) of these patients but caused little or no distress. Six patients reported severe nausea and vomiting prior to surgery. The prevalence of PONV is summarised in Table 2. PONV was reported most frequently immediately upon waking from the anaesthetic (93 patients, 17%), and was moderate or severe in 68 of these patients (73%). Ten patients reported that their PONV was extremely distressing and 13 had three or more emetic episodes. Of the 64 patients experiencing PONV upon leaving the hospital, 29 reported their symptoms as moderate (45%) and eight reported severe symptoms (13%). A further 76 patients (14%) experienced PONV while travelling home; this was moderate in 24 patients (32%) and severe in 13 patients (17%). Nausea and vomiting continued in some patients in the days following surgery although steadily decreasing. PONV was much reduced on the 5th day of the study.

Table 3
Anti-emetic agents administered

	n	%
Prophylactic agent	112	
Droperidol	51	46
Metoclopramide	44	39
5-HT_3 receptor antagonists	10	9
Prochlorperazine	4	4
Dimenhydrinate	1	1
Others	2	2
Treatment agent[a]	50	
Droperidol	8	16
Metoclopramide	36	72
5-HT_3 antagonists	10	20
Prochlorperazine	1	2
Others	6	12

[a] Eleven patients received more than one treatment anti-emetic agent.

Anti-emetic use is summarised in Table 3. Prophylactic anti-emetics were given to 112 patients. Droperidol and metoclopramide were the commonly used prophylactic agents and were given to 51 (46%) and 44 patients (39%), respectively. Metoclopramide was the most used anti-emetic administered to 36 of the 50 patients who subsequently required treatment for PONV. The proportion of patients who experienced PONV before discharge from hospital was similar regardless of whether patients had received prophylactic anti-emetics (21%) or not (19%). A similar result was seen in patients who had PONV after discharge (Table 4). The administra-

Table 2
PONV[a]

	None		Mild		Moderate		Severe		Missing data	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%
Recovery	462	82.4	21	3.7	41	7.3	27	4.8	10	1.8
Leaving hospital	486	86.6	27	4.8	29	5.2	8	1.4	11	2.0
Day 1 (remainder)	467	83.2	31	5.5	32	5.7	13	2.3	18	3.2
Day 2	518	92.3	21	3.7	14	2.5	6	1.1	2	0.4
Day 3	536	95.5	15	2.7	4	0.7	1	0.2	5	0.9
Day 4	539	96.1	11	2.0	2	0.4	2	0.4	7	1.2
Day 5	541	96.4	8	1.4	5	0.9	1	0.2	6	1.1

[a] $n = 561$.

tion of prophylactic anti-emetics did not reduce the severity of PONV: 16% of patients who received prophylactic anti-emetics had moderate or severe PONV, compared with 13% of those who had no prophylaxis. The prevalence of pre-discharge PONV was strongly influenced by surgery type (Table 5). More patients who underwent gastrointestinal procedures had moderate or severe PONV (32%) than obstetric and gynaecological (15%) or general surgical procedures (17%). This was also true post-discharge, although fewer gastrointestinal patients had PONV at this time (27%).

Pre-discharge PONV was most common in patients who had received a combination of volatile anaesthetics and hypnotic agents during surgery, occurring in 35% of patients who received this combination compared with 18% of patients who received hypnotic and opioid anaesthetics (with or without a volatile anaesthetic). Following discharge, the prevalence of PONV was similar in patients who had received a combination of hypnotic, opioid and volatile agents (26%) and volatile and hypnotic agents (27%). The prevalence of post-discharge PONV was low in patients who had hypnotic and opioid anaesthesia (12%).

3.3. Humanistic impact of PONV

The impact of post-discharge PONV was also measured in terms of time lost from work or normal activities due to these symptoms, need for assistance from family and friends and whether carers needed to take time off work. Healthcare resource utilisation was also assessed (visit by doctor or nurse, visit to clinic, admission to hospital). Of the 129 patients who had post-discharge PONV, 45 patients (35%) lost time from work or normal activities. This ranged from half a day (19 patients) to 4 days (three patients) and the median value was 1 day. Forty-two patients needed assistance from friends or family, as a direct result of PONV and 21 carers also needed to take time off work. Three patients required a home visit by a doctor or nurse and five visited a clinic because of PONV. Two patients were admitted to hospital because of PONV. Anti-emetic and pain control medication was used by 130 patients after discharge from hospital. This was prescribed by doctors in 58% of cases; the remainder was purchased from pharmacies. Most of the 23 patients who used anti-emetics after discharge used systemic corticosteroids (ten patients) or metoclopramide (nine patients). Two patients used two different anti-emetic preparations.

3.4. Post-operative pain

Post-operative pain was very common, with 367 patients (65%) reporting pain before discharge from hospital, which was moderate in 184 of these patients (50%) and severe in a further 64 patients (17%). The incidence of pain increased after discharge (412 patients, 73%).

4. Discussion

Most day-case surgical units aim for complete control of PONV and pain prior to discharge. The results from this observational study showed that patients suffered PONV, both in hospital and after discharge. Although PONV decreased with time, some patients reported PONV symptoms up to the fifth day post-surgery. Mild to severe PONV was observed in 16% of patients in the recovery room, in spite of the use of prophylactic and treatment anti-emetics. While the occurrence of PONV is not as high as those reported in one study [4], the figures from the present investigation are comparable to others reported for adult [5] and paediatric patients [6]. These results suggest that PONV is either not adequately recognised or treated in hospital and beyond, or that some of the anti-emetic agents used may be inadequate.

This observational study specifically involved an audit of conventional anti-emetics such as droperidol and metoclopramide which were prescribed to the majority of the patients but about 9% had received ondansetron in violation of the protocol. The data clearly demonstrate that prophylactic administration mainly with the older agents did not appear to be entirely successful, with one fifth of treated patients suffering PONV before discharge and a quarter suffering PONV after discharge. Future observations should be designed to

Table 4
Prevalence of PONV during hospital stay and after discharge home by administration of anti-emetic agents

	PONV before discharge (n (%))			PONV after discharge (n (%))		
	No	Yes[a]	MD[b]	No	Yes[a]	MD
Prophylactic anti-emetic given ($n = 112$)	85 (75.9)	24 (21.4)	3 (2.7)	78 (69.6)	29 (25.9)	5 (4.5)
Prophylactic anti-emetic not given ($n = 448$)	357 (79.7)	86 (19.2)	5 (1.1)	338 (75.4)	99 (22.1)	11 (2.5)

[a] Use of prophylactic anti-emetics for one patient unknown.
[b] MD, missing data.

Table 5
Severity of PONV before discharge by surgery type

Type of surgery	Moderate or severe PONV before discharge (*n* (%))			Moderate or severe PONV after discharge (*n* (%))		
	No	Yes	MD[a]	No	Yes	MD
General surgery ($n = 100$)	83 (83.0)	17 (17.0)	0 (0.0)	81 (81.0)	19 (19.0)	0 (0.0)
Obstetric and gynaecologic ($n = 187$)	157 (84.0)	28 (15.0)	2 (1.1)	162 (86.6)	24 (12.8)	1 (0.5)
Orthopaedic ($n = 135$)	124 (91.9)	10 (7.4)	1 (0.7)	121 (89.6)	12 (8.9)	2 (1.5)
Gastrointestinal ($n = 44$)	30 (68.2)	14 (31.8)	0 (0.0)	32 (72.7)	12 (27.3)	0 (0.0)
Other ($n = 95$)	82 (86.3)	12 (12.6)	1 (1.1)	85 (89.5)	10 (10.5)	0 (0.0)

[a] MD, missing data.

allow comparisons of the use and effectiveness of the older with the newer class of anti-emetics.

In a randomised, double-blind study comparing prophylactic ondansetron and metoclopramide in patients undergoing day-case laparoscopy, 82% of patients who received ondansetron were free from PONV compared with 47% of patients who received metoclopramide [10]. Granisetron was more effective than metoclopramide or droperidol in patients undergoing breast surgery: 83% of patients treated with prophylactic granisetron were free from PONV in the 24-h period following surgery, compared with 57 and 63% of patients who received metoclopramide and droperidol, respectively [11]. In another study 87% of female patients treated with ondansetron were free from PONV in the 3-h period immediately after therapeutic abortion [12].

The occurrence of PONV depends on a variety of factors including the type of surgery and patient characteristics, such as age, gender and past history of PONV. In this study gastrointestinal surgery was associated with the highest incidence of PONV although the numbers of patients undergoing these procedures were small. This was closely followed by general, obstetric and gynaecological surgery. The high incidence of PONV following intra-abdominal surgery [13] is thought to be due to stimulation of vagal afferents during bowel manipulation, as well as the irritation of the bowel and peritoneum caused by inflation of the peritoneal cavity with carbon dioxide during these procedures. In the present study six of 30 patients who underwent ear, nose and throat surgery had PONV. PONV is a common complication of 'bat ear' and middle ear surgery as a result of stimulation of the auriculo–temporal branch of the facial nerve and the labyrinthine pathways, respectively [14]. Gender is another key factor in PONV: 2–4 times more women than men suffer PONV [15]. Nausea and vomiting were significantly more common in female patients who had undergone chemotherapy (79% of female patients versus 69% of male patients, $P = 0.005$) [16]. In developing a risk score for predicting PONV, Apfel et al. [17] identified four predictors, female gender, history of motion sickness or PONV, non-smoking and post-operative opioids. In an observational study of 421 patients undergoing routine surgery, Larsson and Lundberg [18] reported that female gender, balanced anaesthesia, lengthy duration of anaesthesia and abdominal or orthopaedic procedures were the factors most often associated with PONV [18].

The use of opioids is a key factor in PONV, particularly as opioids are widely used in controlling pain, both as a component of balanced anaesthesia and post-operatively. Opioids stimulate nausea and vomiting by acting on a chemoreceptor trigger zone in the area postrema [19]. The degree of PONV experienced depends to some extent on when the opioids were administered, as pre-operative administration results in a higher incidence of PONV [18]. The majority of patients (80%) in the present study received opioids in combination with anaesthetic agents. Of these only 25% received prophylactic anti-emetics, even though the emetogenic potential of opioids is well recognised. Postoperative pain, in particular pelvic and visceral pain, can also lead to PONV [20]. In this situation, nausea is more common than vomiting. Opioids are commonly used to treat postoperative pain in gynaecological and other major surgery. Moderate and severe pain before and after discharge were most common in patients who had undergone obstetric, gynaecological and orthopaedic procedures, patients who also had high incidences of PONV. The use of opioid analgesia in abdominal surgery complicates the issue of PONV, as it is not clear whether the PONV is a result of opioid use, or the surgery itself. While data on pain were collected in this study, an analysis of concomitant drug use was not carried out, and the extent of opioid use in this patient group is unknown. As PONV can increase on movement, an effect on vestibular sensitivity has been suggested. Levels of PONV were higher upon movement in patients in this study, in agreement with this theory. This may also explain the increase in PONV in patients while travelling home from the day case unit.

Humanistic consequences of PONV post-discharge were examined for the 129 patients in this study who reported PONV whilst at home. PONV directly affected

time lost from work and normal activities, with 21 patients taking 1 or more days off work or normal activities. Many patients also needed the assistance of friends and family, with the result that 21 friends and relatives also had to take time off work. Whilst a health economic analysis was beyond the scope of this study it is clear that inadequate control of PONV results in considerable inconvenience to patients who suffer from protracted symptoms. Carroll and et al. [4] reported that patients who experienced PONV following discharge from hospital after day-case surgery were significantly more likely to have impairment of normal activities than those who had no PONV [4]. In this study three patients required home visits by a doctor or nurse, five had to visit a hospital and two needed to be re-admitted to hospital because of PONV. While these numbers are small, they contribute, none the less, to the indirect costs associated with PONV.

Results from this study suggest that inadequate anticipation and control of PONV remains a problem in day-case surgery, in spite of the need to discharge patients who are fully alert and free from pain and PONV. More thorough consideration of risk factors, such as gender, type of surgery, history of nausea and vomiting and the use of older anaesthetic or opioid analgesics, prior to deciding to use anti-emetic agents, should improve patient outcome. It appears, however, that traditional anti-emetics, such as droperidol and metoclopramide, are not always effective in preventing PONV. Published data for the newer agents suggest that the 5-HT_3 antagonists may be more effective in this setting, resulting in less distress to patients and a lower impact on post-discharge activities. Better control of PONV will become increasingly important as day-case surgery increases in popularity with healthcare providers and patients alike. Future observational studies should be designed to compare outcomes with the newer agents.

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