

Original Research Article

Postoperative vomiting/nausea in Chinese patients undergoing bariatric surgery

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Abstract

Purpose: To assess the incidence of post-operative vomiting/nausea (PVN), as well as usage and effectiveness of PVN prophylaxis in Chinese patients receiving bariatric surgery.

Methods: This prospective observational study included 82 patients subjected to bariatric surgery using total intravenous (IV) anesthesia. Patients were given PVN prophylactic treatment as per the local practice depending on Apfel et al criterion for simplified risk score useful for PVN prediction. Post-surgery, the patients were evaluated at 2, 4, 6, 24, 48 and 72 h using a questionnaire. Univariate analysis of risk factors associated with PVN was carried out with Pearson's Chi-squared test for category variables and Mann-Whitney-Wilcoxon test for a continuous variable.

Results: About 69 % of the patients developed PVN within 24 h post-surgery, and the risk increased with increase in the number of PVN risk factors. Significant contrasts were seen with respect to PVN, with higher occurrence in females (81.36 %), when compared to males (39.13 %) within the first 24 h ($p < 0.05$). Two patients got sub-optimum PVN prophylactic therapy as per guidelines, 19 patients had optimum therapy, while 61 patients had supra-optimum therapy. Moreover, 63.94 % of patients who obtained supra-optimum PVN prophylactic therapy experienced PVN within 24 h post-surgery, while 84.21 % of patients with optimum PVN prophylactic therapy experienced PVN within the same period ($p < 0.05$). Overall, 35.37 % of patients experienced serious nausea 24 h post-surgery.

Conclusion: PVN incidence is high, notwithstanding the fact that almost all the patients received optimum or supra-optimum prophylactic therapy. These findings raise doubts regarding the viability and significance of using risk-based PVN prophylactic therapy in patients under bariatric surgery. Thus, further research is needed in this regard.

Keywords: Anesthesia, Bariatric surgery, Postoperative vomiting and nausea

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INTRODUCTION

Obesity is a universally major health problem with increasing incidence. Bariatric surgery is deemed an effective method which is conducted under general anesthesia (GA). Postoperative vomiting/nausea (PVN) is one of the notable side

effects of GA [1- 4]. There is dearth of information on risk of PVN post-bariatric surgery. Numerous studies on PVN risk have been carried out, especially in the current decade.

One of the fundamental issues concerns the choice of therapy, or prophylaxis to be applied to

specific patients. A simplified risk score useful for PVN prediction has been created, with respect to four significant predictive factors namely: non-smoking, female gender, postoperative opioid usage, and a prior motion sickness or PVN history [5]. In addition, a systematic review conducted by Apfel *et al* demonstrated these risk-factors, in addition to volatile anesthetic use, anesthesia use, nitrous oxide, and age [6]. These studies, along with others provide a foundation for guidelines that guide anesthetists in assessing PVN risks in patients, so as to plan relevant anesthetics with prophylaxis of PVN [7]. Risk scoring has become clinically applicable since the last decade. However, challenges appear to persevere in the execution of those scores in regular clinical practice [3,8,9].

Therefore, the present study was carried out to assess PVN incidence, usage, and effectiveness of PVN prophylaxis in Chinese patients receiving bariatric surgery.

METHODS

Patients and general information

This prospective observational study received approval from Institutional Review Board of the Huashan Hospital, Fudan University (approval no. 201510227), and informed consent was obtained from participants. Patients' confidentiality was strictly maintained. The work was conducted as per the guidelines of Helsinki Declaration [10]. A questionnaire was used to gather information regarding pain, PVN events, and side-effects of PVN prophylactic treatment. Patients aged more than 18 years who were receiving Roux-en-Y gastric bypass (RGB) and laparoscopic sleeve gastrectomy (LSG) were included in the study. Patients who had no clinical data, and those who changed to open surgeries were excluded from the study.

Etoricoxib and paracetamol were given in the morning to patients on surgery day. Glycopyrrolate was used as a pre-medication. Anesthesia induction was performed with propofol-remifentanyl, atracurium or succinylcholine, and intubation. The anesthesia was maintained using an infusion of oxygen-air-propofol-remifentanyl, along with additional atracurium doses when necessary. Intravenous (IV) ketobemidone and port-site levobupivacaine amid last phases of surgery were provided.

Patients were given PVN prophylactic treatment as per the local practice depending on Apfel *et al* criterion for simplified risk score useful for PVN prediction [5, 6]. Risk factors of non-smoking,

female gender, postoperative opioid usage, and a prior motion sickness or PVN history was assigned one point. One medication prophylaxis was assigned 2 points, 2 medications was given 3 points, while 3 medications scored 4 points. The prophylactic treatment used were ondansetron IV, betamethasone IV and droperidol IV, in that order. Supplementary prophylactic treatment was provided as deemed fit by an anesthesiologist. Propofol-remifentanyl, the total IV anesthesia in the present study (without the use of volatile anesthetic gas), was considered one PVN prophylaxis treatment [11].

In the postoperative recovery room, patients were given IV rescue analgesics as per routine procedure using alfentanil and ketobemidone, as the need arose. Oral parecoxib was given in the evening post-surgery, while oral paracetamol as well as rescue analgesics of codeine oral and ketobemidone IV were administered in the surgery ward when necessary. Ondansetron IV or droperidol was given as rescue anti-emetic to patients in the recovery room. In the surgery ward, metoclopramide was utilized as rescue anti-emetic when necessary.

Data collection

Data on age, gender, BMI, categorization of ASA physical status, surgery procedures, anesthesia types, previous history PVN or motion sickness history, smoking habit, as well as preoperative and postoperative treatments for PVN and pain relief were recorded.

Post-surgery, patients were evaluated at 2, 4, 6, 24, 48 and at 72 h using a standard questionnaire on scaling of PVN impact [12] along with supplementary queries pertaining to pain. Factors analyzed were PVN event, severity, frequency as well as rescue therapy. Numeric rating scale (NRS) was used for assessment of pain and the need for pain relief [13]. Patients were requested to indicate their pain on a scale of 0 to 10 (0 = no pain; 10 = extreme pain). Inquiries required Yes or No answers, or Likert grade scale. In addition, PVN was estimated from the appearance of vomiting/nausea at pertinent time intervals. Severe nausea was characterized by negative influence on the patient's ability to eat, drink, or socialize. Rescue anti-emetics requirement was characterized as anti-emetics offered up to 72 h postoperatively. Optimum PVN prophylactic therapy was characterized in connection with simplified risk-score as depicted previously. On the off chance that the patient got less PVN prophylactic treatment than suggested, this was considered as sub-optimum. The right sum was categorized

as optimum, and PVN prophylaxis greater than suggested was considered supra-optimum.

Statistical analysis

Values are expressed as numbers with percentages. For PVN risk, 95 % confidence intervals were evaluated utilizing the strategy suggested by Newcombe *et al* [14]. Analysis of all data collected was done using SPSS version 21.0 (SPSS Inc, Chicago). Univariate analyses of risk factors in association with PVN was conducted utilizing Pearson's chi-squared test for category variables and Mann-Whitney-Wilcoxon test for a continuous variable.

RESULTS

Baseline characteristics

Between October 2015 and November 2016, 88 patients were selected in the present cohort. Four of the patients were excluded due to cancellation or postponement of surgeries, whereas post-surgery problems such as bleeding involving extended intubations in two patients. Overall, 82 patients were included. The mean age of the patients was 41 ± 9 years. About 71.95 % of the patients were females. As per simplified risk scores, 68 (83 %) patients were at higher PVN risk, with scores of 3 and 4. Total IV anesthesia was given to all patients using propofol-remifentanyl. The prophylactic treatment in all patients utilized ondansetron (84.14 %), betamethasone (100 %) and droperidol (26.83 %). Table 1 shows the clinical as well as demographic data of all included patients.

PVN risk at various time intervals

In just 2 h post-surgery, 43 patients (52.44 %) developed PVN, and in 6 h post-surgery, 68.29 % of patients experienced PVN. About 69 % of patients developed PVN within 24 h post-surgery. Serious nausea risk was seen in 12 patients (14.63 %) 2 h post-surgery, and this increased to 23 patients (28.05 %) within 6 h post-surgery. Within 24 h post-surgery, 29 patients (35.37 %) developed PVN. The data on PVN risk in bariatric surgery patients at various time intervals are presented in Table 2.

PVN risk within 24 h post-surgery, and risk factors

Rescue anti-emetics were received by nearly 68.3 % of patients with general PVN, while 82.45% of patients had severe PVN amid initial 24 h. The mean timing of initial rescue therapy

was 142 min. About 81 % of patients needed supplementary analgesics (ketobemidone or alfentanil) within 6 h post-surgery, while 83 % of the patients needed supplementary analgesics 24 h post-surgery. Significant contrasts were seen with respect to PVN, with higher occurrence in females (81.36 %) than in males (39.13 %) 24 h post-surgery ($p < 0.01$). Likewise, PVN risk was significantly associated with PVN scores, with 42.85 % of patients with a score of 2 experiencing PVN within 24 h, when compared with 65.79% of patients having a score of 3, and 86.67 % of patients with a score of 4 ($p = 0.039$). Two patients got sub-optimum PVN prophylactic therapy as per guidelines, 19 patients had optimum therapy, while 61 patients experienced supra-optimum therapy (Table 3).

In addition, 63.95 % of patients who had supra-optimum PVN prophylactic therapy experienced PVN 24 h post-surgery, relative to 84.21 % of patients with optimum PVN prophylactic therapy.

Table 1: Clinical/demographic characteristics (N = 82)

| Characteristic | n (82) |
|--|-------------|
| Age (y)* | 41 (9) |
| Body mass index (BMI; kg/m ²)* | 42 (6.8) |
| BMI>45 | 26 (31.7%) |
| Female | 59 (71.95%) |
| ASA classification | |
| 1 | 18 (21.43%) |
| 2 | 54 (65.85%) |
| 3 | 10 (12.19%) |
| PVN scores | |
| 1 | 0 |
| 2 | 14 (17.07%) |
| 3 | 38 (46.34%) |
| 4 | 30 (36.59%) |
| PVN risk factors | |
| Non-smoking | 78 (95.12%) |
| PNV history | 22 (26.83%) |
| Motion sickness history | 32 (39.02%) |
| Postoperative opioids' need | 82 (100%) |
| PVN prophylaxis | |
| Antiemetics | 82 (100%) |
| Betamethasone | 82 (100%) |
| Ondansetron | 69 (84.14%) |
| Droperidol | 22 (26.83%) |
| Anesthesia | |
| Total intravenous anesthesia | 82 (100%) |
| Anesthesia time (min)* | 102 (24) |
| Surgery | |
| Roux-en-Y gastric bypass | 71 (86.59%) |
| Laparoscopic sleeve | |
| gastrectomy | 11 (13.41%) |
| Surgery time (min)* | 68 (18) |

ASA = American Society of Anesthesiologists; PVN = Postoperative vomiting/nausea. *Values are expressed as mean with range, unless otherwise stated

Table 2: PVN risk in bariatric surgery patients at various time intervals

| Risk | 0-2h | 0-6h | 2-24h | 0-24h | 24-72h |
|----------------|-------------|-------------|-------------|-------------|-------------|
| PVN | 43 (52.44%) | 56 (68.29%) | 48 (58.54%) | 57 (69.51%) | 16 (19.51%) |
| Vomiting | 2 (14.63%) | 8 (21.95%) | 6 (19.51%) | 3 (28.05%) | 7 (8.54%) |
| Nausea | 43 (52.44%) | 56 (68.29%) | 48 (58.54%) | 57 (69.51%) | 14 (17.07%) |
| Serious Nausea | 12 (14.63%) | 23 (28.05%) | 25 (30.49%) | 29 (35.37%) | 7 (8.54%) |

PVN = Postoperative Vomiting/Nausea. Values are expressed as numbers and percentage

Table 3: PVN risk amidst initial 24 h post-surgery and risk factors

| Characteristic | n (82) | Patients with PVN | Odds Ratio (CI) | P-value |
|---|--------|-------------------|--------------------|---------|
| Age (y) | | | | |
| <50 | 56 | 41 (73.21%) | 4.21 (1.46-11.16) | 0.048 |
| ≥50 | 26 | 16 (61.54%) | | |
| Body mass index (BMI, kg/m ²) | | | | |
| >40 | 63 | 43 (68.25%) | 1.28 (0.59-4.04) | 0.882 |
| ≤40 | 19 | 14 (73.68%) | | |
| Gender | | | | |
| Male | 23 | 9 (39.13%) | 11.49 (4.22-29.67) | <0.01 |
| Female | 59 | 48 (81.36%) | | |
| PVN scores | | | | |
| 1 | 0 | 0 | NA | 0.039 |
| 2 | 14 | 6 (42.85%) | Ref | |
| 3 | 38 | 25 (65.79%) | 3.28 (0.86-11.43) | |
| 4 | 30 | 26 (86.67%) | 6.13 (1.62-22.95) | |
| Smoking | | | | |
| Y | 4 | 4 (100%) | | 0.49 |
| N | 78 | 53 (67.95%) | | |
| PVN history | | | | |
| Y | 22 | 14 (63.64%) | 0.76 (0.29-2.58) | 0.813 |
| N | 60 | 43 (71.67%) | | |
| Motion sickness history | | | | |
| Y | 32 | 24 (75%) | 1.84 (0.68-4.85) | 0.344 |
| N | 50 | 33 (66%) | | |
| Surgery | | | | |
| Roux-en-Y gastric bypass | 71 | 48 (67.61%) | 0.64 (0.08-2.87) | 0.752 |
| Laparoscopic sleeve gastrectomy | 11 | 9 (81.81%) | | |
| Surgery time | 31 | 23 (74.19%) | 0.52 (0.18-1.81) | 0.874 |
| <60 min | 51 | 34 (66.67%) | | |
| ≥60 min | | | | |
| PVN prophylaxis | | | | |
| Betamethasone | 82 | 57 (69.51%) | NA | NA |
| Y | 0 | 0 | | |
| N | | | | |
| Ondansetron | 69 | 51 (73.91%) | 1.82 (0.43-11.13) | 0.546 |
| Y | 13 | 6 (46.15%) | | |
| N | | | | |
| Droperidol | 22 | 14 (63.64%) | 0.91 (0.33-2.82) | 0.967 |
| Y | 60 | 43 (71.67%) | | |
| N | | | | |
| PVN prophylaxis as per guidelines | 61 | 39 (63.94%) | 0.46 (0.09-2.18) | 0.336 |
| Supraoptimum | 19 | 16 (84.21%) | Ref | |
| Optimum | 2 | 2 (100%) | NA | |
| Suboptimum | | | | |
| Maximum NRS ≥5 | 55 | 41 (74.55%) | 2.15 (0.91-6.23) | 0.511 |
| Y | 27 | 16 (59.26%) | | |
| N | | | | |
| Rescue pain therapy | 63 | 49 (77.78%) | 2.98 (0.98-8.95) | 0.034 |
| Y | 19 | 8 (42.11%) | | |
| N | | | | |

CI = 95 % confidence interval; NRS = Numeric rating scale; PVN = Postoperative Vomiting/Nausea. Values are expressed as mean with range, if not stated otherwise

Two patients with sub-optimum prophylactic therapy experienced PVN within 24 h post-surgery. Rescue pain therapy need was significantly associated with PVN within 24 h post-surgery; 77.78 % of patients who had rescue pain therapy had PVN, in contrast to 42.11 % for patients who were not under rescue pain therapy ($p = 0.0034$). The PVN risk was increased with NRS score greater than 5, although the association was not significant.

DISCUSSION

This investigation has demonstrated that a significant portion of patients (69.51 %) who underwent bariatric surgery developed PVN. The high frequency of PVN occurred, regardless of the fact that almost all patients got optimum or supra-optimum prophylactic therapy. This is a greater incidence of PVN than those accounted for in previous studies with regard to bariatric surgery [15-17]. However, the results are in line with those reported by Bataille *et al* and Halliday *et al* [3,18].

Almost every patient with prevailing PVN experienced initial PVN event within 6 h post-surgery. However, serious nausea risk increased from 28.05 % within 6 h post-surgery to 35.37 % within 24 h post-surgery. Emphasis on PVN therapy within that period might lessen the duration of PVN and allow faster recovery. Serious nausea which was characterized as nausea restricting nutrition or mobilization, was 35.37 %. This outcome might be of greater clinical relevance than the usual PVN frequency because it restricts mobilization and elevates suffering. Lessened mobilization could result in pneumonic difficulties [19], and might likewise increase the danger of deep vein thrombophlebitis. Restricted mobilizations bring about an expanded requirement for patients care and, in all likelihood, brings about greater aggregate cost for admissions.

Opioid analgesics were given to patients at various phases during admissions. Two studies [15, 16] demonstrated significant reduction in PVN of patients under bariatric surgery using multi-modal postoperative analgesics as well as sans opioid total IV anesthesia. In the present study, opioid usage was in greater association with PVN and might add to the higher rate of PVN noted. It is feasible that when patients get greater PVN prophylactic therapy earlier or within surgery, PVN can be avoided within 6 h post-surgery. This might be in combination with the best plan of postoperative analgesics, thereby resulting in decreased need for rescue opioid doses by patients. Every patient in the cohort

was on treatment at the same facility, obtaining standard anesthetics as well as PVN prophylactic therapy. Two patients got sub-optimum PVN prophylactic therapy as per guidelines, while 61 (74.39 %) patients got supra-optimum therapy. The PVN risk was 84.21 % in patients who got optimum PVN prophylactic therapy, while the corresponding value in patients who got supraoptimum therapy was 63.94 %. It is conceivable that patients under bariatric surgery need supplementary PVN prophylactic therapy, in contrast to patients under general surgery. A study by Moussa *et al* showed that PVN prophylaxis medications lessened PVN risk in patients under bariatric surgery.

All the patients got optimum or supraptimum prophylactic therapy except two patients. This demonstrates that it is feasible to execute PVN algorithms at healthcare facilities. The significance of application of the present study regarding PVN has featured in various reports [3,8,21]. Studies conducted by Apfel *et al* [5,6] showed female gender as the only risk factor for PVN. This is consistent with the results of the present study, with 81.36 % of females experiencing PVN within 24 h post-surgery, in spite of getting optimum or supra-optimum PVN prophylactic therapy. It is hard to hypothesize as to the reason for that great incidence. Thus, further research on this cohort in future investigations of PVN in patients under bariatric surgery is necessary. The non-significant nature of additional risk factors such as non-smoking, prior motion sickness or PVN history is a conceivable limitation in this study. In a larger population sample, these components could end up having significance like in studies by Apfel *et al* [5,6]. However, the collection of information from an extensive number of patients who were subjected to one type of surgery might require multicenter studies.

One of major peripheral afferent pathways for eliciting PVN is vagal nerve. Roux-en-Y gastric bypass and LSG involves operation of the stomach as well as incision via vagal nerve branches, regardless of whether the bigger branches alongside shorter curvature has lesser damage, particularly in LSG. Such firsthand traumas of surgery might lead to greater PVN incidence, as developed in present cohort. This is intensified by the part that opioids play, since they impact on PVN through peripheral pathway and influence intestinal motility. The usual motility of the stomach is changed during nausea. It can be hypothesized that changes in stomach and intestinal motility post-surgery might lead to nausea [22-24].

The results of the present study show that in standard clinical practice, it is vital to concentrate on different plans in patients under bariatric surgery than conventional PVN prophylactic therapy due to greater PVN events. It could be that providing multi-modal prophylactic therapy to patients and evading volatile anesthetics is just insufficient. Different strategies for PVN prophylactic therapy are accessible, and assessing such supplementary techniques like acupunctures, anti-histamines or neurokinin1 receptor antagonists might be helpful in future investigations [25-27].

Limitations of the study

Certain intrinsic limitations require consideration while interpreting the study outcomes. The study results should have been compared with results from a control cohort. Since this is a one-center study with very limited number of patients, one should be cautious in generalizing the results.

CONCLUSION

The findings of the study demonstrate high PVN incidence, although almost all patients had optimum or supra-optimum prophylactic therapy, with 69.51 % experiencing PVN whereas 35.37 % had serious nausea within 24 h post-surgery. Overall, these outcomes raise dubiety regarding viability and significance of the utilization of risk-based PVN prophylactic therapy in patients under bariatric surgery; this, therefore, calls for further research.

DECLARATIONS

Conflict of interest

No conflict of interest is associated with this work.

Contribution of authors

We declare that this work was done by the authors named in this article and all liabilities pertaining to claims relating to the content of this article will be borne by the authors. The whole is designed and supervised by Jing-Hui He. Li-Ping Zhao and Lu-Jia Zou collected the data and performed all the experiments.

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