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The effect of intraoperative different oxygen concentrations on nausea and vomiting in morbidly obese patients undergoing laparoscopic bariatric surgery

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Abstract

Aim: Postoperative nausea and vomiting (PONV) is a common problem due to many factors, and is especially seen in the first two hours after the operation. In this study, we aimed to investigate the effect of different intraoperative oxygen concentrations on nausea and vomiting in morbidly obese patients.

Material and Methods: After the approval of the ethics committee, 206 patients who underwent laparoscopic bariatric surgery (LBS) in 2018 were included in the study by analyzing their files. The patients were divided into two groups according to the O_2 concentrations used. Those given 30% oxygen (n=87) were determined as GrupLO, and those given 70% oxygen (n=119) were determined as GrupHO. Demographic data of the patients, body mass index, ASA score, hemodynamic parameters and anesthetic agents used, Apfel score, visual analog scale (VAS) score, PONV score, and the amount of metoclopramide administered in the post- anesthetic care unit (PACU) were recorded.

Results: There was no significant difference between the groups in terms of demographic data and the anesthetic drugs used. PONV occurring in PACU was 66.66% (58/87) in Group LO and 44.53% (53/119) in Group HO. There was a statistically significant difference between the groups in the post-operative nausea-vomiting score ($p<0.05$). The amount of metoclopramide administered in PACU was lower in Group HO and it was statistically significant.

Discussion: In this study, we found that the frequency of PONV was higher in morbidly obese patients who underwent LBS, and intraoperative high oxygen concentrations reduced the incidence of PONV.

Keywords

Morbid Obesity, Intraoperative Oxygen Concentration, Postoperative Nausea-Vomiting, Laparoscopic Bariatric Surgery

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Introduction

Postoperative nausea and vomiting (PONV) is a common problem due to many factors and is seen especially in the first two hours after the operation [1, 2]. It is controversial whether obesity is a risk factor for PONV. Although there are studies that indicate an increase or decrease in the incidence of PONV in patients with a relatively high body mass index (BMI) who go to surgery under general anesthesia, also some authors argue that there is no risk factor for PONV [3, 4, 5]. However, laparoscopic bariatric surgeries (LBS) are high-risk surgeries in terms of postoperative nausea-vomiting due to both increased intra-abdominal pressure and incisions affecting the vagus nerve, which is the afferent nerve of the nausea-vomiting pathway [6]. PONV, can cause aspiration in unconscious patients with inadequate laryngeal reflexes, leading to nosocomial infections, morbidity and mortality. In addition, it can increase hospital expenses by delaying the patient's departure from the recovery room and discharge from the hospital [7, 8]. All these reasons lead to the search for solutions to prevent PONV.

In this study, it was aimed to investigate the effect of different intraoperative oxygen concentrations on PONV in morbidly obese patients who underwent LBS.

Material and Methods

In this study, the files and e-archive records of morbidly obese patients who had LBS in 2018 were examined. The study was approved by University Non-Invasive Research Ethics Committee (date: 28/01/2019, number 308685). Two hundred and six patients, whose data we could access completely, were included in the study. ASA IV patients were excluded from the study. The patients were divided into two groups as patients who received high oxygen (Group HO) and low oxygen (Group LO). Group LO (n=87) received 30% oxygen and Group HO (n=119) received 70% oxygen. Maquet Servo-i (Siemens, Germany) was used as the anesthesia machine, and the fresh gas flow was applied at 2 liters/minute. Patients' ages, genders, BMIs, ASA scores, and oxygen saturations in the intra-operative and postanesthetic care unit (PACU) were enlisted. Intravenous and volatile anesthetics, opioid analgesics, muscle relaxant antagonists, post-operative VAS score, and antiemetic amount used in PACU were recorded.

PONV score: 1: No nausea-vomiting, 2: There is nausea, 3: There is retching, 4: There is vomiting

Apfel Score: 1-Female gender, 2-History of postoperative nausea-vomiting or motion sickness, 3-Non-smoking, and 4-Intraoperative or postoperative opioid use parameters were evaluated.

General anesthesia protocol was applied to all patients included in the study. All patients were given 2-3 mg/kg propofol based on lean body weight and 0.6 mg/kg rocuronium and 0.5 µg/kg remifentanil based on ideal body weight at induction. In the anesthesia maintenance, 0.01 - 0.1 µg/kg /min remifentanil infusion, sevoflurane and desflurane were used as inhalation anesthetics. For postoperative analgesia, 1.5 mg/kg tramadol or 0.5 mg/kg pethidine were given with 50 mg dexketoprofen intraoperatively.

Statistical analysis

Statistical analysis was performed using the Statistical Package for the Social Sciences 22.0 software. Data were expressed as "mean ± standard deviation". In the comparison between groups, categorical variables were evaluated with the "chi-square test" and numerical variables were evaluated with the "independent sample t test". Confidence interval was determined as 95% and a p-value less than 0.05 was considered statistically significant.

Ethical Approval

Ethics Committee approval for the study was obtained.

Results

There was no difference between the groups when age, gender, ASA, BMI, Apfel Score, duration of surgery and VAS at admission to PACU were evaluated (p>0.05) (Table 1). SaO_2 values of the patients were over 90% at all measurement times and there was no statistically significant difference in terms of inhalation anesthetics, muscle relaxant antagonists and postoperative analgesic agents used in the groups (p>0.05).

Post-operative nausea-vomiting score is shown in Table 2 for both groups. There was a statistically significant difference between the groups (p<0.05). PONV that occurred in patients in the post-operative care unit was 66.66% (58/87) in Group LO and 44.53% (53/119) in Group HO, and it was statistically significant (p<0.05). When the amount of metoclopramide administered in PACU was compared between the groups, less rescue antiemetic was administered to Group HO. This difference was statistically significant (p<0.05) (Table 3).

Table 1. Demographic Data, ASA, Body Mass Index, Apfel Score, VAS, Operation Time.

	Group LO	Group HO	P-value
M/ F	28 / 59	52 / 67	0,063
BMI	45,08 ± 4,64	45,40 ± 5,29	0,65
Age	34,87 ± 9,60	36,26 ± 10,00	0,331
ASA	III	III	-
Apfel Score	1,34 ± 0,80	1,33 ± 0,95	0,945
VAS	4,27 ± 2,13	4,15 ± 1,96	0,666
Surgery Time (min)	79,78 ± 18,25	82,85 ± 17,32	0,22

Table 2. Post operative Nausea Vomiting Score.

	Group LO	Group HO	p-value
No nausea/ vomiting	29	66	0,009
Nausea	37	34	
Retching	17	18	
Vomiting	4	1	

Table 3. Amount of metoclopramide administered in the PACU.

	Group LO	Group HO	p value
No Drug	54	82	0,015
10 mg metoklopramid	25	36	
20 mg metoklopramid	8	1	

Discussion

One of the most common complaints in patients undergoing surgical intervention under general anesthesia is PONV along with postoperative pain. Female gender, non-smoking status, history of PONV or motion sickness, and opioid usage are defined risk factors for PONV. General anesthesia administrations, volatile anesthetics and N_2O, young age, duration of anesthesia, types of surgical methods are other risk factors [9]. Although the information about the frequency of PONV in obese patients is controversial, it has been reported to be high in bariatric surgeries [10]. Although it varies according to the anesthesia and surgery methods, there are studies reporting that the incidence of PONV reaches up to 98.7%. Therefore, antiemetic prophylaxis is recommended for these patient groups [11].

There is disagreement as to whether higher oxygen use would be beneficial as a strategy to reduce the risk of PONV. Different results were found in two meta-analyses at this point. Sungur et al. found it ineffective and Hovaguimian et al. found it effective in reducing the incidence of PONV [12, 13]. At the same time, Hovaguimian et al. stated that no side effects were observed in the lungs and surgical site infections were less common. In other studies, it has been reported that the incidence of PONV has decreased in abdominal and laparoscopic gynecological surgeries, but did not affect such surgeries as thyroidectomy and strabismus operations [14-17]. Greif et al. showed that high oxygen concentrations reduced the incidence of PONV in colon surgery [18]. As it is known, the three main pathophysiological mechanisms triggering PONV are the vestibulocochlear tract, the central chemoreceptor trigger zone, and the local gastrointestinal tract. Surgical stress reduces intestinal mobilization by reducing gastrointestinal blood flow, and surgical manipulations, although not global, may result in inadequate tissue perfusion in some gastrointestinal areas. Studies have reported that all these causes may affect the local gastrointestinal tract and high oxygen concentrations will reduce intestinal ischemia, thus can decrease the incidence of PONV.

Morbid obesity is a risk factor for increased intra-abdominal pressure. Increased intra-abdominal pressure leads to hypo-perfusion in the gastrointestinal tract [19]. Therefore, morbidly obese patients undergoing LBS may be more susceptible to nausea-vomiting by the local intestinal tract.

Administration of oxygen at high concentrations was thought to be associated with the development of atelectasis. But in a systematic review, Mattishent et al. declared that there was no increase in complications of high oxygen usage when compared the 80% and 30-35 % O_2 [20]. Similarly, in a randomized controlled study, there was no difference between groups in terms of adverse effects when 80% O_2 was used [21].

Limitations

There are some limitations of this study. The number of patients between the two groups was different because patients who had LBS in a certain time interval were included in the study. Due to the retrospective nature of the study, the anesthetic and analgesic drugs used could not be randomized between groups. Another limitation of the study is that only parameters in the PACU were evaluated and these parameters were not followed afterwards. This is due to the retrospective nature of the study. Further randomized controlled studies are needed to recommend the use of high O_2 concentrations to prevent PONV in this patient group and LBS.

Conclusion

It is clear that the incidence of PONV depends on many factors. Although the mechanism of reducing PONV by intraoperative high O_2 administration has not been clearly demonstrated, it may be due to preventing intestinal ischemia. In our study, we found that the incidence of PONV was high in morbidly obese patients who underwent LBS, and the use of intraoperative high O_2 concentrations reduced the PONV.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study 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. No animal or human studies were carried out by the authors for this article.

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Conflict of interest

None of the authors received any type of financial support that could be considered potential conflict of interest regarding the manuscript or its submission.

References

1. Jin Z, Gan TJ, Bergese SD. Prevention and Treatment of Postoperative Nausea and Vomiting (PONV): A Review of Current Recommendations and Emerging Therapies. Ther Clin Risk Manag. 2020; 16: 1305-17.

2. Cavaye J, Dai B, Gurunathan K, Weir RM, Yerkovich S, Gurunathan U. NK1 receptor antagonists versus other antiemetics in the prevention of postoperative nausea and vomiting following laparoscopic surgical procedures: a systematic review and meta-analysis. J Anaesthesiol Clin Pharmacol. 2022; 38(1): 35-47.

3. Kwon YS, Choi, JW, Lee HS, Kim JH, Kim Y, Lee JJ. Effect of a Preoperative Proton Pump Inhibitor and Gastroesophageal Reflux Disease on Postoperative Nausea and Vomiting. J Clin Med. 2020; 9(3): 825.

4. Kranke P, Apfel C, Papenfuss T, Rauch S, Löbmann U, Rübsam B, et al. An increased body mass index is no risk factor for postoperative nausea and vomiting: A systematic review and results of original data Note. Acta Anaesthesiol Scand. 2001; 45(2): 160-6.

5. Jong HK, Mingi H, Young JK, Lee HS, Kwon YS, Lee JJ. Effect of Body Mass Index on Postoperative Nausea and Vomiting: Propensity Analysis. J Clin Med. 2020; 9(6): 1612.

6. Halliday TA, Sundqvist J, Hultin M, Walldén J. Post-operative nausea and vomiting in bariatric surgery patients: an observational study. Acta Anaesthesiol Scand 2017; 61(5): 471-9.

7. Holst JM, Klitholm MP, Henriksen J, Vallentin MF, Jessen MK, Bolther M, et al. Intraoperative respiratory and hemodynamic strategies for reducing nausea, vomiting, and pain after surgery: Systematic review and meta-analysis. Acta Anaesthesiol Scand. 2022; 66(9): 1051-60.

8. Berg SM, Braehler MR. The Postanesthesia Care Unit. In: Gropper MA, editor. Miller's Anesthesia. 9th ed. Philadelphia, PA: Elsevier; 2020.p.2586-613.

9. Stoops S, Kovac A. New insights into the pathophysiology and risk factors for PONV. Best Pract Res Clin Anaesthesiol. 2020; 34(4): 667-79.

10. Groene P, Eisenlohr J, Zeuzem C, Dudok S, Karcz K, Hofmann-Kiefer K. Postoperative Nausea and Vomiting in Bariatric Surgery in Comparison to Non-Bariatric Gastric Surgery. (Videosurgery and Other Miniinvasive Techniques.) 2019; 14(1): 90-5.

11. Ziemann-Gimmel P, Schumann R, English W, Morton J, Wadhwa A. Preventing Nausea and Vomiting After Bariatric Surgery: Is the Apfel Risk Prediction Score Enough to Guide Prophylaxis? Obes Surg. 2020; 30(10): 4138-40.

12. Sungur OM, Kranke P, Sessler D, Apfel CC. Does supplemental oxygen reduce postoperative nausea and vomiting? A meta-analysis of randomized controlled trials. Anesth Analg. 2008; 106(6): 1733-8.

13. Hovaguimian F, Lysakowski C, Elia N, Tramèr MR. Effect of intraoperative high inspired oxygen fraction on surgical site infection, postoperative nausea and vomiting, and pulmonary function: systematic review and meta-analysis of randomized controlled trials. Anesthesiology. 2013; 119(2): 303-16.

14. Goll V. Ondansetron is no More Effective than Supplemental Intraoperative Oxygen for Prevention of Postoperative Nausea and Vomiting. Anesth Analg. 2001; 92(1): 112-18.

15. Šimurina T, Mraović B, Mikulandra S, Sonicki Z, Sulen N, Dukić B, et al. Effects

of high intraoperative inspired oxygen on postoperative nausea and vomiting Tatjana in gynecologic laparoscopic surgery. J Clin Anesth. 2010; 22(7): 492-8.
16. Treschan TA, Zimmer C, Nass C, Stegen B, Esser J, Peters J. Inspired oxygen fraction of 0.8 does not attenuate postoperative nausea and vomiting after strabismus surgery. Anesthesiology. 2005; 103(1): 6-10.
17. Joris L, Poth NJ, Djamadar AM, Sessler DI, Hamoir EE, Defêchereux TR, et al. Supplemental oxygen does not reduce postoperative nausea and vomiting after thyroidectomy. BJA. 2003; 91(6): 857-61.
18. Greif R, Lacincy S, Rapt B, Hickle RS, Sessler DI. Supplemental oxygen reduces the incidence of postoperative nausea and vomiting. Anesthesiology. 1999; 91(5): 1246-52.
19. Reintam Blaser A, Regli A, De Keulenaer B, Kimball EJ, Starkopf L, Davis WA, et al. Incidence, Risk Factors, and Outcomes of Intra-Abdominal Hypertension in Critically Ill Patients-A Prospective Multicenter Study (IROI Study). Crit Care Med. 2019; 47(4): 535-42.
20. Mattishent K, Thavarajah M, Sinha A, Peel A, Egger M, Solomkin J, et al. Safety of 80% vs 30-35% fraction of inspired oxygen in patients undergoing surgery: a systematic review and meta-analysis. Br J Anaesth. 2019; 122(3): 311-24.
21. Ferrando C, Aldecoa C, Unzueta C, Belda FJ, Librero J, Tusman G, et al. Effects of oxygen on post-surgical infections during an individualised perioperative open-lung ventilatory strategy: a randomised controlled trial. Br J Anaesth. 2020; 124(1): 110-20.

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