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Original contribution

Effects of high intraoperative inspired oxygen on postoperative nausea and vomiting in gynecologic laparoscopic surgery☆,☆☆,★,★★

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Abstract

Study Objective: To assess the efficacy of intraoperative inspired oxygen fractions (FIO_2) of 0.8 and 0.5 when compared with standard FIO_2 of 0.3 in the prevention of postoperative nausea and vomiting (PONV).

Design: Prospective, randomized, double-blinded, controlled study.

Setting: General hospital, postanesthesia care unit (PACU), and gynecology floor room.

Patients: 120 ASA physical status I and II women, aged 21 to 76 years, undergoing elective gynecologic laparoscopic surgery.

Interventions: Patients were randomized to receive a gas mixture of 30% oxygen in air (FIO_2 = 0.3, Group G30), 50% oxygen in air (FIO_2 = 0.5, Group G50), or 80% oxygen in air (FIO_2 = 0.8, Group G80); there were 36 patients in each group. A standardized sevoflurane general anesthesia, postoperative pain management, and antiemetic regimen were used.

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Measurements: Frequency of nausea, vomiting, and both was assessed for early (0 to two hrs) and late PONV (two to 24 hrs), along with use of rescue antiemetic, degree of nausea, and severity of pain.
Main Results: There was no overall difference in the frequency of PONV at the early and late assessment periods among the three groups. G80 patients had significantly less vomiting than Group G30 at two hours, 3% (1/36) vs. 22% (8/36), respectively, $P = 0.028$. Nausea scores, rescue antiemetic use, pain scores, and opioid consumption did not differ among the groups.
Conclusion: High intraoperative FIO_2 of 0.8 and FIO_2 of 0.5 do not prevent PONV in patients without antiemetic prophylaxis. An intraoperative FIO_2 of 0.8 has a beneficial effect on early vomiting only.

1. Introduction

Gynecologic laparoscopic surgery increases the risk of postoperative nausea and vomiting (PONV), with an incidence as high as 80% [1]. Pharmacological prophylaxis does not eliminate the incidence of PONV completely, and it may increase the costs and the risk of adverse events [2]. Supplemental oxygen may be an additional simple method in multimodal PONV prophylaxis. The published data, to date, remain controversial. An intraoperative FIO_2 of 0.8 was as effective as ondansetron prophylaxis in women undergoing general anesthesia for prolonged gynecologic laparoscopic surgery [3]. However, two reports suggested that a perioperative FIO_2 of 0.8 did not prevent PONV after general anesthesia for short ambulatory gynecologic laparoscopic procedures [4,5] (Table 1). A factorial trial of 6 interventions for PONV, which included mixed general and gynecologic surgery, found no differences in the frequency of PONV in patients receiving an FIO_2 of 0.8 when compared with an FIO_2 of 0.3, but the effect of oxygen on early PONV was not analyzed [6]. A recent meta-analysis concluded that an FIO_2 of 0.8 compared with an FIO_2 of 0.3 to 0.4 did not reduce PONV after general anesthesia for abdominal and non-abdominal surgery, although early vomiting was significantly reduced in the abdominal surgery patients [7]. Nevertheless, studies of patients receiving an FIO_2 of 0.5 were excluded from the meta-analysis. An FIO_2 of 0.5 is more commonly used in anesthesia practice when a higher FIO_2 is desirable. One study found no effect of an FIO_2 of 0.5 on PONV in patients undergoing breast surgery, but suggested a beneficial effect on early postoperative vomiting [8]. A recent PONV consensus panel concluded that supplemental oxygen had no beneficial effects on PONV. However, this conclusion was based on an FIO_2 of 0.8 [9]. There is a paucity of data on the influence of an FIO_2 of 0.5 on PONV and the effects of oxygen on early and late PONV.

Thus, we designed a prospective, randomized, double-blinded, controlled study to test the hypothesis that high intraoperative oxygen (FIO_2 of 0.5 and FIO_2 of 0.8) compared with a routine FIO_2 of 0.3 reduces the frequency of PONV over the first 24 postoperative hours in women undergoing elective gynecologic laparoscopic surgery with general anesthesia. The potential for the dose-response effects in reducing the frequency of PONV with higher FIO_2 also was evaluated.

2. Materials and methods

After General Hospital, Zadar Ethics Committee approval, written, informed consent was obtained from 120 adult, ASA physical status I and II patients, presenting for elective gynecologic laparoscopic surgery. Exclusion criteria were obesity (body mass index > 30 kg/m²), pulmonary diseases, pregnancy or breast feeding, known hypersensitivity to drugs used in the study protocol, use of antiemetics, psychotropic drugs, and hormone and steroid use within three days of surgery. Patients with comorbidities that may have had an influence on PONV also were excluded, ie, diseases that impaired gastric motility (diabetes mellitus, chronic cholecystitis, gastrointestinal disease, neuromuscular disorders, neuropathies, and liver dysfunction), as well as those patients with vestibular disease, history of migraine headache, central nervous system injury, renal impairment, irregular menstrual cycles (duration < 21 or > 35 days and/or variations between cycles > 4 days), alcoholism, or opioid addiction. Finally, after study enrollment patients were excluded if they unexpectedly developed intraoperative drug allergy, severe intraoperative hypotension, perioperative hypoxia, excessive blood loss, difficult intubation, to open procedures or postoperative complications.

All patients received 7.5 mg of midazolam orally one hour before the surgery with no prophylactic antiemetics. Standard monitoring was used, including electrocardiography, noninvasive blood pressure, pulse oximetry, and capnography. Anesthesia was induced with thiopental sodium 5 mg/kg, fentanyl one to two μg/kg, and vecuronium 0.1 mg/kg intravenously (IV). Patients' lungs were manually ventilated via face mask with an FIO_2 of 1.0 for three minutes before endotracheal intubation. Patients were randomized to three groups by computer-generated random numbers to receive a gas mixture consisting of 30% oxygen in air ($FIO_2 = 0.3$, Group G30), 50% oxygen in air ($FIO_2 = 0.5$, Group G50), or 80% oxygen in air ($FIO_2 = 0.8$, Group G80).

Anesthesia was maintained with sevoflurane (end-tidal concentration ~ one minimum alveolar concentration) and