RESEARCH ARTICLE

Effect of Supplemental Perioperative Oxygen 80% in Postoperative Nausea and Vomiting in Patients Undergoing Cataract Surgery

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Background: Postoperative nausea and vomiting (PONV) leads to an increase in intraocular pressure (IOP) and its side effects, which should be controlled using the least complicated method. Therefore, the purpose of this study was to evaluate the effect of 80% supplemental perioperative oxygen on PONV in patients undergoing cataract surgery.

Methods: The present double-blind clinical trial was conducted on 201 patients undergoing cataract surgery. The subjects were selected by convenience sampling method and randomly divided into two groups of oxygen 30% administration and oxygen 80% administration. The operation of patients was performed with the same surgical procedure and team. After the operation, the incidence rate of PONV was recorded in both groups and compared along with other variables by SPSS software using descriptive statistics and chi-square.

Results: There was no significant difference in age and sex between the two groups. The incidence rate of PONV was high in both groups, with statistically significant higher value in the group with 30% supplemental oxygen compared to the group with 80% supplemental oxygen (p=0.000).

Conclusion: The use of 80% perioperative oxygen concentration could reduce the PONV severity.

Keywords: Postoperative nausea and vomiting; Cataract surgery; 80% oxygen concentration

Nausea and vomiting after cataract surgery is a common symptom, with an incidence of up to 14% [1]. This complication is unpleasant for the patient, but this issue has been underestimated due to other major concerns such as increased risk of subsequent pneumonia [2]. Postoperative nausea and vomiting (PONV) may cause dehydration, electrolyte imbalance, and increase intraocular pressure (IOP) and intracranial pressure (ICP) and pressure on suture lines and surgery site and even esophageal rupture [3-4]. The use of anaesthetic drugs is one of the ways to control PONV, but this intervention not only increases the costs of admission but also predisposes the patient to drug side effects [5-6]. The best way to prevent PONV is to use a method that, in addition to the extraordinary effect, has the least complications [6]. Although cataract surgery with and without glaucoma leads to decreased IOP, other factors that increase IOP after surgery enhance the risk of glaucoma in the patients [7-8]. Although the use of supplemental oxygen for PONV control is not universally accepted, and with the hypothesis that it could possibly reduce nausea induced by nitrous oxide, studies focused on the effects of different concentrations of oxygen on PONV severity [9]. In a study of Purhonen et al. on breast surgeries, it was emphasized that the use of high concentrations of oxygen increases the likelihood of side effects and it is better to use a concentration of 50% to control PONV. Ultimately, this concentration of oxygen was not effective in controlling nausea and vomiting during the first 24 hours after surgery versus 30% concentration and there was a need to inject an anti-nausea drug in both groups [6]. Shimurina et al. compared three concentrations of 30, 50 and 80% oxygen for controlling nausea and vomiting in patients with gynecologic laparoscopic surgery and reported that only 80% concentration was effective in controlling PONV, but none of them was effective in PONV control [10]. According to the results of previous studies and that cataract surgery is often performed in elderly people, and the IOP elevation increases the risk of glaucoma in these patients, so that even clear lens extraction is recommended to prevent glaucoma [7-8] we aimed therefore to study the effect of supplemental perioperative oxygen 80% on PONV in patients undergoing cataract surgery.

Methods

The present double-blind clinical trial was performed after obtaining approval by the Deputy of Research and Technology and the Ethics Committee of Zahedan

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University of Medical Sciences and informed consent on 201 patients referred for elective cataract surgery at Alzahra Eye Hospital in Zahedan. The patients were selected by the convenience sampling method based on inclusion criteria, and then randomly divided into two groups of oxygen 30% and 80% administration. Patient's year of birth was used to randomize for randomization. Patients born in odd year were in the intervention group (receiving 80% oxygen) and those born in even year in the control group (receiving 30% oxygen). Sample size was considered to be 201 according to previous studies and the formula for calculating the sample size [10-11]. The inclusion criteria were ages between 20 and 70 years old; ASAI-II; and no history of Meniere syndrome, motion sickness and other inner ear disorders, diabetes, neuromuscular disorders, cholecystitis and pancreatitis, and other disorders leading to nausea and vomiting (pregnancy and gastrointestinal disorders), addiction, migraine and use of anti-nausea drugs in the last 24 hours; and willingness to participate in the study. The patients, whose surgery lasted more than an hour, requiring a larger corneal incision and postoperative suture were excluded from the study. The patients who met the inclusion criteria were divided into two groups. For all patients, an angiocath 18G was then fixed in the antecubital fossa, followed by ringer serum infusion at a dose of 5 cc/kg. Non-invasive monitoring of the heart rhythm and arterial oxygen saturation and blood pressure was performed by the monitoring device (SAADAT, Iran). The oxygen was administered to patients with a pure oxygen face mask. Anesthesia induction was carried out with sodium thiopental (4 mg/kg/IV), midazolam (20 µg/kg/IV), fentanyl (2 µg/kg/IV) and atracurium (0.5 mg/kg/IV). Patient's intubation was performed with video laryngoscope. The ventilation of the patient started with an anaesthetic machine with a volume of 8 cc/kg. The administration oxygen was 80% in the intervention group and 30% in the control group, and immediately a nasogastric tube was fitted to the patients in both groups. The same team unaware of group allocation performed surgery. During the operation, anesthesia maintenance was done with isoflurane 1-2 MAC, oxygen and remifentanil infusion (0.05-0.1 µg/kg/min). After completing the surgery, the remaining neuromuscular block was reversed with neostigmine (0.04 mg/kg/IV) and atropine (0.02 mg/kg/IV). The NG tube was removed from the patients. After extubation, the patients were prescribed with oxygen using the face mask continued for both groups (8 litres per minute) until hospitalization for recovery. Then, up to 6 hours after surgery, a trained nurse unaware of group allocation measured the PONV level of patients based on the following grading.

Grade I: No nausea.

Grade II: Mild nausea– no vomiting

Grade III: Moderate nausea– Once vomiting, antiemetic medication administered with effect.

Grade IV: Severe nausea– frequent vomiting, antiemetic medication administered but ineffective.

The patients with grade 3 or higher nausea were treated with 4 mg of ondansetron. Data were then analyzed by SPSS version 25 software using descriptive statistics, Chi-square and independent t-test.

Results

The mean age of the patients participating in the study was 55.5 ± 9.5 years. There was no significant difference in age between the two groups according to independent t-test (Table 1). In the group of patients receiving supplemental oxygen 80%, 50 (49.5%) were male and 51 (50.5%) were female. In the group of patients receiving supplemental oxygen 30%, 55 (55%) were male and 45 (45%) female. In comparison of the gender with Chi-square test, two groups showed no significant difference (P=0.435).

In the study of the incidence rate of nausea in patients, statistical analysis showed that 29 (28.7%) in the group receiving supplemental oxygen 80% and 35 (35%) in the group receiving supplemental oxygen 30% had the postoperative nausea. Comparing the incidence rate of postoperative nausea showed no significant difference between the two groups (P=0.339). Of the 29 patients who had nausea in the group receiving supplemental oxygen 80%, 7 had mild nausea (grade 2), 11 had moderate nausea (grade 3), and 11 had severe nausea (grade 4). In the group receiving supplemental oxygen 30%, 35 were nauseous, of which 14 were moderate (grade 3) and 21 had severe nausea (grade 4). There was a significant difference in the incidence of mild and severe nausea between the two groups with Chi-square, but there was no significant difference between the two groups in terms of the incidence of moderate nausea (Table 1).

Table 1- Comparison of perioperative and postoperative variables in two groups

Variables	group receiving supplemental oxygen 30%	group receiving supplemental oxygen 80%	P- value
Age	53.9±8.9	57.1±9.7	0.076
Perioperative PaO2	99±8mmHg	109±11mmHg	0.098
Perioperative SaO2	97±2	100	0.113
Duration of general anesthesia	44±15min	38±11min	0.981
End of surgery PaO2	96±3mmHg	99±8mmHg	0.088
End of surgery SaO2	98±1	100	0.113
People with mild nausea	0	7	0.001
People with moderate nausea	14	11	0.361
People with severe nausea	21	11	0.000

There was no significant difference in the duration of general anesthesia between the two groups. Surveying the mean arterial oxygen saturation of haemoglobin (SaO2) and partial pressure of oxygen (PaO2) showed very close values

with no significant difference between the two groups (Table 1).

Discussion

The results obtained from the present study showed that the use of two percentages of 30 and 80 of perioperative oxygen could not reduce the incidence rate of PONV but was effective in the PONV severity. In the group receiving supplemental oxygen 80%, 7 had mild nausea while there was not even one mild nausea in the group receiving supplemental oxygen 30%. Comparison of subjects with severe nausea showed that the frequency of people in the group receiving 30% supplemental oxygen was almost twice as high as the other group. However, there was no significant difference in the incidence of moderate nausea in the two groups. In line with our results, Greif et al. reported that the use of supplemental oxygen could reduce PONV. In justifying this mechanism, they argued that although there is not a well-known mechanism for the effect of oxygen on PONV, the slight reduction of intestinal ischemia may have reduced PONV, according to a study conducted in patients with colorectal surgery. Given the difference in the number of patients participating in two studies and the lowering effect of oxygen on PONV severity, we also suggest that there is an unknown mechanism in this regard [12]. Orhan-Sungur et al. reported that the lowering effects of high concentrations of oxygen on nausea and vomiting are probably due to the reduction of the effects of nausea and vomiting caused by nitrous oxide [9]. However, our patients did not receive nitrous oxide. Hovaguimian et al. in a systematic review and meta-analysis concluded that the use of high concentrations of perioperative oxygen has poor effects for controlling postoperative nausea while reducing the incidence of infections in the surgical site and not increasing the risk of postoperative atelectasis [13]. In the comparison of SaO2 and PaO2 levels, the studied patients in both groups showed slight difference, but not statistically significant. Since one of the important criteria for determining the complications of oxygen is a large increase in PaO2 level, our patients who were ventilated with 80% perioperative oxygen had higher levels of PaO2 than the other group, but not statistically significant. Although there is some doubt that the use of high oxygen levels can cause damage to airways and alter arterial blood gases [14], several studies did not fully confirm this hypothesis. The pure oxygen administration at the end of the operation can lead to atelectasis within a few minutes, but 80% oxygen administration has the lowest level of atelectasis [15-16]. One of the limitations of this study is failure to examine the incidence rate of atelectasis and other complications related to the administration of high oxygen levels in the patients. It is recommended that future studies take comprehensive examination of the anti-nausea effects and side effects of oxygen. The results of this study in another meta-analysis indicated that although early studies reported that the administration of oxygen 80% reduced the PONV, these results were not confirmed in other clinical trials afterwards [9]. Seidy et al. reported that supplemental perioperative oxygen did not reduce intraoperative nausea and vomiting, but it was effective in reducing PONV severity of patients. The patients examined in this study were pregnant women under spinal anesthesia for cesarean section, who had also visceral manipulation that could trigger nausea and vomiting. Our patients were under general anesthesia and it was impossible to evaluate the intraoperative nausea. There is unanimous agreement on reducing the severity of nausea and vomiting between the two studies [17]. In accordance with the results of this study, Izadi et al. emphasized that the administration of supplemental perioperative oxygen 80% could reduce the PONV in patients undergoing tonsillectomy [18]. Ochmann et al. suggested a different mechanism for the lowering effect of oxygen on nausea and vomiting. The supplemental intraoperative oxygen 80% reduces serotonin levels in plasma and controls significantly the PONV. Consistent with our results, the patients who received 80% oxygen in the above study had a higher level of PaO2, which is a completely predictable subject and the absence of complications for patients should be studied more [19]. Contrary to the results of the present and many other studies, Joris et al. stated that no anti-nausea and vomiting effect was observed with 80% supplemental oxygen [20]. Beyond the results of our review, Goll et al. reported that 80% oxygen administration was more effective and less risky for controlling PONV compared with 8-mg ondansetron injection while receiving 30% oxygen. However, their patients underwent bowel resection and visceral manipulation that increased the risk of nausea and vomiting [21]. Phillips et al. compared two levels of 70% and 21% oxygen in patients undergoing cesarean section, and reported that the supplemental oxygen had no effect on the control of intraoperative and postoperative nausea and vomiting severity [22].

Conclusion

The administration of supplemental perioperative oxygen 80% had no effect on the incidence rate of nausea and vomiting after cataract surgery, but it could decrease the postoperative nausea and vomiting severity.

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