Original Article

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Comparing the Effects of Propofol Infusion and Inhalation Isoflurane on Hemodynamic Variations and Depth of Anesthesia in Cataract Surgery Patients

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ABSTRACT

BACKGROUND AND OBJECTIVE: In cataract surgery, given that most patients are older people, surgery with general anesthesia requires better hemodynamic control along with maintaining the depth of anesthesia. The present study was conducted to compare the effects of propofol and isoflurane on hemodynamic variations and depth of anesthesia in cataract surgery patients.

METHODS: The present clinical trial was conducted among 60 patients who were cataract surgery candidates. The patients were randomly assigned to propofol group (n = 30) and isoflurane group (n = 30). One µg/kg fentanyl and one mg/kg intravenous lidocaine were administered in both groups and anesthesia was induced using 1.5 – 2.5 mg/kg propofol. In order to maintain anesthesia, 50 – 75 µg/kg/min propofol was administered in the first group and 1% isoflurane was administered in the second group. Depth of anesthesia, hemodynamic variations, recovery time, wake-up time, nausea and vomiting were recorded and compared in the two groups.

FINDINGS: Depth of anesthesia was similarly below 60 in both groups at different times. Hemodynamic variations were not significantly different in the two groups. Mean recovery time in propofol and isoflurane groups was 20.56 and 15.4 minutes, respectively (p<0.001), and wake-up time in the two groups was 8.83 and 7.16 minutes, respectively (p= 0.004).

CONCLUSION: The results showed that there was no difference between the effects of these two drugs on hemodynamics and depth of anesthesia, but recovery time and wake-up time in propofol group were significantly higher than isoflurane group.

KEY WORDS: *Cataract, Depth of Anesthesia, Hemodynamic Variations, Propofol, Isoflurane.*

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Introduction

Blindness and impaired vision are among the problems that affect people's quality of life (1). Cataracts have been one of the leading causes of visual impairment worldwide, and statistics show that approximately 90% of patients live in developing countries, which can be surgically resolved (2). In cataract surgery, prescribing the right amount of anesthetic to the patient has always been an issue for specialists in the field. Specialists seek to ensure that the patient is healed in a short period of time while ensuring blood circulation with adequate depth of anesthesia (3, 4). The most common method for examining the depth of anesthesia in operating rooms relies on changes in heart rate, blood pressure, pupil reactivity, tears, and decreased limb movement and respiratory shape, which is not a reliable method. A monitoring that directly assesses the analgesic and hypnotic effects of an anesthetic during surgery will allow anesthesiologists to maximize the satisfactory effects of anesthetic and it minimizes adverse cardiopulmonary effects. One of these methods is bispectral index (BIS) monitor (5). BIS monitoring shows the electrical status of the cortex similar to electroencephalogram (6).

BIS monitoring has been found to be beneficial in reducing the use of anesthetic drugs and reducing the incidence of waking up during surgery and recovery duration (7, 8). Isoflurane is a type of halogenated ether used for inhalation anesthesia (9). Isoflurane is one of the most important drugs in the health system on the WHO Model Lists of Essential Medicines. Increasing concentrations of isoflurane decreases the mean arterial blood pressure in a dose-dependent manner, which was linked to a decrease in systemic vascular resistance rather than a decrease in cardiac output (10). Propofol is a short-acting injectable drug with hypotonic and amnesic effects that is used in the induction and maintenance of anesthesia (11).

Propofol dose-dependently exhibits the most significant decrease in systemic blood pressure compared to other anesthetics, and its effect on blood pressure becomes more pronounced with age or rapid injection (12). In most studies, the hemodynamic differences between the propofol and isoflurane groups were not significant. In some studies, hemodynamic stability was higher in the propofol group, however, it was not significantly different from isoflurane. Furthermore, depth of anesthesia has not been evaluated in most of the studies, so in this study we compared the depth of anesthesia in the two groups receiving propofol and isoflurane and its effect on hemodynamics and depth of anesthesia.

Methods

This clinical trial was approved by the Ethics Committee of Babol University of Medical Sciences under code MUBABOL.REC.1394.289 enrolled in clinical trial system (IRCT20100208003305N9), and was conducted among 60 patients undergoing cataract surgery in Class I and II of the American Society of Anesthesiologists (ASA). After obtaining informed consent, patients were randomly divided into two groups of 30. Patients with a history of cardiovascular disease, diabetes and uncontrolled hypertension, liver or kidney failure, patients with psychiatric problems, patients addicted to alcohol and drugs, and patients with difficult airway were excluded.

Patients were placed on the operating room bed in a supine position and standard monitors such as pulse oximeter, non-invasive blood pressure, and electrocardiogram (ECG) were connected to the patient and the heart rate, arterial blood pressure (systolic, diastolic, and moderate) were monitored and recorded, while BIS monitor was connected to the patient. All patients received 5 ml/kg Ringer's solution, 1 µg/kg fentanyl and 1 mg/kg lidocaine intravenously. Prior to induction, vital signs and BIS were recorded. Propofol (1.5–2.5 mg/kg) and atracurium (5 – 10 mg) were then injected to all patients and after induction of anesthesia, laryngeal mask airway was used for patients.

Then, 4 lit/min N2O and 4 lit/min O2 were also administered. After induction, 50–75 µg/kg/min propofol was administered to the first group and 1% isoflurane (Soha Helal Company) was administered to the second group to maintain anesthesia. The levels of BIS (vista device) was recorded in the questionnaire at 1, 3, 5, 8 minutes and was then recorded every 5 minutes according to the time of operation. After surgery, anesthesia maintenance drugs and N2O were discontinued, and after the patient gained normal breathing pattern, oropharyngeal suction was stopped and LMA was removed. At the end of surgery, hemodynamic and BIS indices were recorded when the anesthetics were discontinued and LMA was removed. The most recent vital signs were recorded, the patient was transferred to the recovery room, hemodynamic changes and vomiting nausea were monitored and relevant information was recorded. Wake up time from the moment of discontinuation of the drug until opening the eyes by calling and recovery time from the moment of discontinuation of the drug until the patient received a score higher than 9 according to the Aldrete Score (13) were considered and recorded (Mishira) (It should be noted that this method measures 5 parameters of movement, breathing form, stable hemodynamic status, level of consciousness, and peripheral blood oxygen saturation. It has a maximum of 10 and requires at least 9). The data were transferred to SPSS-19 software and analyzed by Chi-Square, Fisher's exact test, Paired T-test, Repeated Measure Test, and Mann – Whitney test. P<0.05 was considered statistically significant.

Results

Mean age of patients in propofol group was 67.46±12.46 and in isoflurane group was 64.53±13.77 years, and there was no significant difference between the two groups. Furthermore, 16 (53.3%) patients in propofol group were men, and 14 (46.7%) patients were women, while 15 (50%) patients in isoflurane group were men and 15 (50%) patients were women. BIS values were measured in 9 stages and compared. According to these findings, the depth of anesthesia in both groups was enough and was within the recommended range and only in the third minute was significantly higher in the propofol group than the isoflurane group (Table 1). Moreover, the mean arterial pressure in the two groups at different minutes was not significantly different (Fig 1). The difference in average heart rate was similar between the two groups (Fig 2). The mean wake up time was 8±2.41 minutes and recovery time was 17.98±3.84 minutes. Recovery time and wake up time in propofol group was significantly longer than the isoflurane group (p<0.001 and p=0.004, respectively) (Table 2).

Table 1. Mean depth of anesthesia at different times of anesthesia in the two study groups

Different times of anesthesia	Depth of anesthesia (BIS) Propofol Mean±SD (median)	Depth of anesthesia (BIS) Isoflurane Mean±SD (median)	P-value
Before anesthesia	9.36±2.95 (95)	94.4±2.89 (95)	0.970
Minute 1	54±12.56 (54.5)	56.46±11.16 (58)	0.424
Minute 3	43.63±9.7 (43)	49.4±11.92 (48)	0.048
Minute 5	46.06±10.95 (46.5)	47.53±9.42 (47.5)	0.615
Minute 8	46.23±9.29 (43.5)	48.26±9 (48)	0.433
Minute 13	47.76±9.40 (48.5)	48±6.95 (48)	0.906
Minute 18	46.56±8.35 (46.5)	47.3±7.28 (46)	0.739
Minute 23	48.38±13.58 (45)	48.6±7.86 (47)	0.563
After removing LMA	84.86±5.76 (86)	86.77±4.23 (88)	0.219
18 minutes before anesthesia*	47.80±9.05 (48)	47.10±8.36 (47.5)	0.918

*** Significant difference in depth of anesthesia in groups**

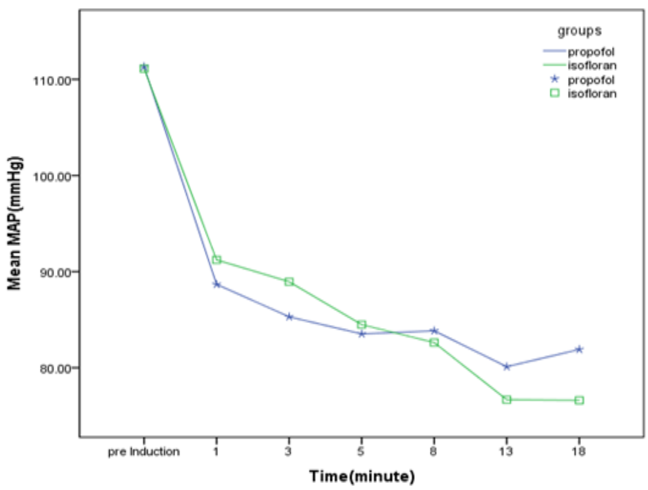

Figure 1. Mean arterial pressure at different minutes of anesthesia

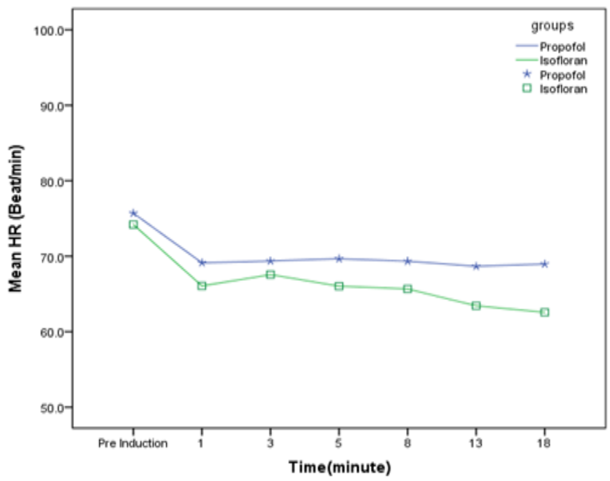

Figure 2. Mean heart rate of patients at different minutes of anesthesia

Table 2. Mean wake up time and recovery time in the two groups

Duration	Propofol Mean±SD	Isoflurane Mean±SD	P-value
Wake up time (minutes)	8.83±2.36	7.16±2.19	0.004
Recovery time (minutes)	20.56±2.82	15.4±2.88	<0.001

Discussion

In this study, recovery time and wake up time in the propofol group was longer than in the isoflurane group. However, BIS and hemodynamic changes were not significantly different between the two groups. In the study of Rabiee et al., which used sodium thiopental and propofol to induce anesthesia in pregnant women undergoing cesarean section, anesthesia depth was enough in the two groups and there was no significant difference between the two groups (14). The results of this study were similar to the present study, which may be due to the similarity of anesthetic drugs and their doses. Inconsistent with our study, in the study of Hosseinzadeh et al., the mean BIS at 5, 10, 15, 30, 45 minutes in the isoflurane anesthesia group was significantly higher than the propofol group, but in both groups the range of BIS changes was within the defined range (15).

The difference between this study and the present study could be due to the use of remifentanil (0.25 µg/kg/min) in the propofol group, whereas in the present study, propofol and isoflurane were used alone in each group. In the present study, there was no significant difference in the mean heart rate between the two groups. In the study of Mortazavi et al., induction of anesthesia was similar in both groups, but isoflurane was used to maintain anesthesia in one group and propofol was used in another group, and the mean heart rate was not significantly different between the two groups (8). In some other studies, there was no significant difference in heart rate between the two groups of isoflurane and propofol (17–20). Contrary to the present study, the study of Hosseinzadeh et al. showed that the mean heart rate in the propofol group was significantly lower than in the isoflurane group (15), and this statistical difference could be due to the drug dosage (1–2.5% isoflurane, and 100–150 µg/kg/min propofol) and the use of remifentanil in the propofol group. There was no significant difference between the two groups in terms of systolic, diastolic blood pressure and mean arterial pressure in the present study. In the study of Sharifian et al., induction of anesthesia was similar in both groups, but isoflurane was used to maintain anesthesia in one group and propofol was used in another group, and there was no significant difference between the two groups in terms of mean arterial pressure (16).

In some studies, induction of anesthesia was similar in both groups, but isoflurane was used to maintain anesthesia in one group and propofol was used in another group, and there was no significant difference between the two groups in terms of systolic and diastolic blood pressure (17–20). In our study, the recovery time in the propofol group was significantly longer than the isoflurane group. In the study of Mishra et al., propofol was used as the inducer and maintainer of anesthesia in the first group while sodium thiopental was used to induce anesthesia and isoflurane to maintain it in the second group, and recovery time was not significantly different between the two groups (18). Khalid et al. performed their study on 60 patients undergoing laparoscopic cholecystectomy with mean age of 45 years. In this study, 1.5 mg/kg propofol was used for induction of anesthesia in both groups, but 1–2% isoflurane was used to maintain anesthesia in one group and 100 µg/kg/min propofol was used in the other group. Recovery time in the propofol group was significantly shorter than the isoflurane group (19). Considering that in our study, recovery time of propofol is longer than isoflurane and this finding is different from most studies, the main reason may be attributed to the distribution and excretion of the drug, duration of anesthesia and type of surgery. The results showed that there was no difference between the effects of these two drugs on hemodynamics and depth of anesthesia, but recovery time and wake up time in propofol group were significantly higher than isoflurane.

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