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MIDDLE EAST JOURNAL OF ANESTHESIOLOGY
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The Middle East Journal of Anesthesiology (Middle East J. Anesth), commonly known as MEJA, was first published in June 1966. It received its International Standard Serial Number (ISSN 0544-0440) in 1981. MEJA was licensed by the Lebanese Ministry of Information Decision No. 84 that was published in the Lebanese Official Gazette No.22 in 28/5/1992. MEJA was accepted for inclusion in the Index Medicus and MEDLARS databases in 1976.

The Middle East Journal of Anesthesiology was first published in June 1966 by Dr. Bernard Brandstater, Chairman and Professor in the Department of Anesthesiology at the American University of Beirut – Medical Center and School of Medicine. Dr. Brandstater assumed the role of the first Editor-in-Chief of the journal and gave it the famous motto "For some must watch, while some must sleep" (Hamlet – Act III, Sc. Ii). He also chose its symbol, the poppy flower (Papaver Somniferum), because the poppy flower was first cultivated in the Middle East and has given a unique service to the suffering of humankind for thousands of years. The journal is a non-profit publication of the Department of Anesthesiology at the American University of Beirut and is managed by volunteer staff from the department.

MEJA is published three times a year (February, June, and October) and has an Editorial Executive Committee consisting of faculty members from the department in addition to consultant editors from various parts of the world. MEJA has a worldwide circulation and was made available electronically since 2008.

The main objective of the journal is to act as a forum for publication, education, and exchange of opinions by promoting basic science and clinical research publications in the field of Anesthesiology.

MEJA has followed a policy to dedicate total issues for regions in the Middle East. To date, 17 regional issues have been published: Iran (June, 1969), Egypt (June, 1970), Lebanon I (February, 1971), Syria (October, 1971), Turkey (June, 1973), Saudi Arabia I (February, 1979), USA I (October, 1979), Lebanon II (February, 1984), Saudi Arabia II (June, 1985), USA II (February, 1986), Qatar (October, 1986), Jordan I (June, 1987), Jordan II (October, 1988), Saudi Arabia III (October, 1993), Saudi Arabia IV (February, 1999), Lebanon III (February, 2004).

It is important to recognize the February and June issues of 1983 that were dedicated to the experiences of the American University of Beirut – Medical Center staff during the tragic Lebanese war. These two issues also inaugurated the new cover design that uses the name of the journal and its symbol the poppy flower depicted in the colors of the Lebanese national flag. Furthermore, to celebrate the arrival of the third millennium (Year 2000), a special issue on the history of anesthesia in the Middle East was published (Vol. 15, No.4, February 2000). With increased awareness and challenges imposed by the COVID-19 pandemic, a special issue was dedicated (Vol. 27, No. 2, June 2020).

The Middle East Journal of Anesthesiology gained a posture of excellence as evidenced by the "Book Review", which appeared in the journal Anesthesia & Analgesia (Volume 63, p. 704-708, 1984) in which Dr. Nicholas Green, Professor and Chairman of the Department of Anesthesiology at Yale University School of Medicine, USA while describing MEJA wrote "…this journal has consistently proven to be one of the most interesting and educationally rewarding of the 30 or so regional journals about anesthesiology published throughout the world…".

"For some must watch, while some must sleep"

(Hamlet-Act. III, Sc. ii)

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Original Clinical Research

Case Report

Original Clinical Research

Evaluation of the Cardioprotective Effect of Sevoflurane and Desflurane in Patients with Ischemic Heart Disease Undergoing Non-Cardiac Surgery: A Randomized Study

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Abstract

Background: Sevoflurane and desflurane were used to provide a perioperative cardiac protection in coronary artery bypass grafting surgery. The aim of the study was to evaluate the cardiac protective effect of sevoflurane and desflurane in patients with ischemic heart disease undergoing non-cardiac surgery.

Methods: The study included 186 patients with ischemic heart diseases undergoing non-cardiac surgery and classified into two groups. Sevoflurane group: The patients received sevoflurane (end-tidal concentration 2% to 3%) as an inhalational agent during the surgery. Desflurane group: The patients received desflurane (end-tidal concentration 4% to 6%) as an inhalational agent during the surgery. The monitors included the troponin I and creatinine kinase-MB level, electrocardiography (ECG) changes, acute myocardial infarction, heart rate, mean arterial blood pressure, emergence and extubation times, incidence of nausea and vomiting.

Results: There were perioperative minimal and insignificant increases in the troponin I and creatinine kinase-MB in patients of the two groups, and the difference between the two groups was insignificant (P>0.05).There were insignificant changes in the perioperative heart rate or mean arterial blood pressure between the two groups (P>0.05).The emergence and extubation times were prolonged with sevoflurane than the desflurane (P=0.025, P=0.015 respectively). Incidence of nausea and vomiting was significantly higher with sevoflurane than desflurane (P=0.037).

Conclusion: The sevoflurane and desflurane induce a similar cardioprotective effect in patients with ischemic heart disease undergoing non-cardiac surgery. Sevoflurane and desflurane are associ-

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ated with minimal changes in the postoperative cardiac enzymes, and can be safely used in patients with coronary artery diseases undergoing non-cardiac surgery.

Key words: Sevoflurane; Desflurane; Troponin I; CK-MB isoenzyme; Cardioprotection; non-cardiac surgery.

Introduction

Patients with coronary artery diseases undergoing non-cardiac surgery are exposed to the increased risk of perioperative severe complications such as myocardial ischemia, myocardial infarction, heart failure, arrhythmias, cardiac arrest, increased morbidity and mortality.[1-4] The incidence of perioperative myocardial ischemia is 18%-74% in patients with coronary artery disease undergoing non-cardiac surgery.[2]

The use of particular anesthetics for the maintenance of general anesthesia is very important to protect against the perioperative ischemia.[2] Sevoflurane and desflurane are the most common volatile anesthetics used to improve the perioperative cardiac function during cardiac and non-cardiac surgery.[5-7] We hypothesized that sevoflurane and desflurane provide an equal cardioprotective effect in patients with ischemic heart disease undergoing non-cardiac surgery. The aim of the present study was to evaluate the cardioprotective effect of sevoflurane and desflurane in patients with ischemic heart disease undergoing non-cardiac surgery.

Material and methods

After approval from the local ethics committee (48/2016, 23/03/2016), and obtaining written informed consent from all patients, we included 186cardiac patient with coronary artery disease (ischemic heart disease, percutaneous transluminal coronary angioplasty, or history of coronary artery bypass grafting), ejection fraction ≥ 45%, ASA III–IV(American Society of Anesthesiologists) physical status III and IV), New York Heart Association II-IV (NYHA classification) undergoing elective non-cardiac surgery through 2016 to 2019. The exclusion criteria were patients with poor ventricular function, severe valvular disease, congestive heart failure, severe respiratory disease, obese patients or emergency. The patients were assessed using New York Heart Association (NYHA), and American Society of Anesthesiologists Physical Status Score (ASA). All patients were evaluated preoperatively by cardiologists and anesthesiologists. Investigations such ECG and transthoracic echocardiography were done for all patients for evaluating the function of the myocardium and cardiac valves, diagnosis and treatment of ischemic heart diseases and patients on anticoagulants were managed by cardiologist preoperatively. All patients received their medications for hypertension, ischemic heart disease, or arrhythmia approximately two hours prior to anesthesia induction.

The patients were randomly allocated (the concealment of allocation was done by using random numbers generated through excel) into two groups: In the Desflurane group (n=93), patients received desflurane (end-tidal concentration 4% to 6%) as an inhalational agent during the whole procedure. In the Sevoflurane group (n=93), patients received sevoflurane (end-tidal concentration 2% to 3%) as an inhalational agent during

the whole procedure. End-tidal concentrations of sevoflurane and desflurane were collected every 5 minutes during the procedure using Dräger infinity C700 (Dräger, Lübeck Germany).

For all patients and under local anesthesia, a radial arterial cannula and peripheral venous cannula G 18 or 16 were inserted before induction, and central venous line was inserted after induction for monitoring of central venous pressure, administration of inotropic drugs and vasodilators if needed. After attaching the monitors (ECG, pulse oximeter, invasive and non-invasive arterial blood pressure), the induction of anesthesia was done for all patients by pre-oxygenation, with 100% oxygen, intravenous fentanyl (1-2µg/kg), etomidate (0.3mg/kg), and atracurium (0.5mg/kg). After tracheal intubation, anesthesiawas maintained with oxygen: air (50:50%), and sevoflurane or desflurane according to the study medication protocol, fentanyl infusion (1-3µg/kg/hr), and atracurium (0.5mg/kg/hr). The ventilation was adjusted to maintain the end-tidal $PaCO_2$ between 30 and 35 mmHg. Volatile anesthetic concentration was adjusted to maintain the mean arterial blood pressure and heart rate within ±20 % of the preinduction baseline values. Intraoperative tachycardia (heart rate >100 bpm), and systemic hypertension (systolic arterial blood pressure >20% above baseline), were managed by increasing the end-tidal concentration of sevoflurane or desflurane by increments of 1.0 % and bolus doses of fentanyl (0.5-1µg/kg). Intraoperative fluids were given cautiously and guided by the central venous pressure. Intraoperative hypotension (systolic arterial blood pressure <20% below baseline) was managed by bolus doses of ephedrine 5-10 mg and fluid administration and if persisted, dopamine infusion was started. Bradycardia (heart rate<60 bpm) was managed by a bolus dose of atropine (0.02 mg/kg). At the end of surgery, the volatile agent was discontinued, and controlled ventilation with 100% oxygen was maintained until end-tidal volatile anesthetic concentration was less than 0.1 %. At the end of the procedure, dopamine infusion was weaned gradually and discontinued in the operative room if the patients tolerated. Intravenous lidocaine 2% (1mg/kg) was given for all patients two minutes before removal of endotracheal tube to provide smooth extubation. Residual neuromuscular blockade was reversed with a combination of neostigmine 0.05 mg/kg and atropine 0.02 mg/kg intravenously. At the ends of surgery, the patients were transferred to post-anesthesia care unit with closed monitoring and observation for 2 to 4 hours. Most of the patients were shifted to the ward, while few patients were transferred to the intensive care unit according to preoperative plan. Postoperative nausea and vomiting were managed by intravenous administration of ondansetron (0.1-0.15mg/kg).

Monitoring of patients included heart rate, mean arterial blood pressure (MAP), continuous electrocardiograph with automatic ST-segment analysis (leads II and V), central venous pressure, arterial oxygen saturation, troponin I and creatinine kinase-MB level, required pharmacological support, end tidal concentration of sevoflurane and desflurane, total dose of fentanyl and atracurium, and arterial blood gases. The heart rate, and mean blood pressure were serially collected at the baseline, after induction of anesthesia, every 5 minutes during the procedure, at the end of surgery, and every 5 minutes in the post-anesthetic care unit. Troponin level

and creatinine kinase-MB level were checked at the following timepoints; T0: the preoperative value, T1: directly after surgery, T2: 6 hours postoperatively, T3: 12 hours postoperatively, T4: 24 hours postoperatively, T5: 2nd postoperative day, T6: 3rd postoperative day, T7: 5th postoperative day. Also, the incidence of hypotension, hypertension, tachycardia or bradycardia, and any adverse effects were recorded.

The primary outcome was the cardioprotective effect diagnosed by the stability of the hemodynamic status of the patients (changes in the heart rate and blood pressure), and the postoperative cardiac markers (troponin I and creatinine kinase-MB)]. Secondary outcomes were the requirement for pharmacological support and the safety of the study medications, which was assessed by the occurrence of any adverse events.

Statistical analysis

Power analysis was performed using the Chi square test for independent samples on the frequency of patients associated with elevated postoperative troponin I level, because it was the main outcome variable in the present study. A pilot study was done before starting this study because there are no available data in literature for the comparison of sevoflurane and desflurane in patients with ischemic heart disease undergoing non-cardiac surgery. The results of the pilot study showed that the postoperative troponin I level increased in 30% in sevoflurane group, and 50% in desflurane group. Taking power 0.8, alpha error 0.05, and beta 0.2, a minimum sample size of 93 patients was calculated for each group.

Data were described as mean ± standard deviation (± SD), or frequencies (number of cases) and percentages when appropriate. Comparison of numerical variables between the study groups was done using Student *t* test for independent samples. For comparing categorical data, Chi square (χ^2) test was performed. Exact test was used instead when the expected frequency is less than 5. *P* values less than 0.05 was considered statistically significant. All statistical calculations were done using computer program SPSS (Statistical Package for the Social Science; SPSS Inc., Chicago, IL, USA) version 15 for Microsoft Windows.

Results

Table 1 shows no significant difference regarding the demographic data, co-morbidities, preoperative medications, NYHA classification, and the ASA physical status score.

There were no significant changes in the perioperative heart rate or mean arterial blood pressure between the two groups throughout the timeline of the study (Table 2).

Table 1: Preoperative data of patients

Variable			Sevoflurane group (n=93)	Desflurane group (n=93)	P-value
Age (year)			58.20±6.79	56.90±7.10	0.203
Weight (kg)			82.40±11.54	84.25±12.35	0.292
Gender (Male/Female)			49 (53)/44 (47)	52 (56)/41 (44)	0.768
Hypertension			93 (100)	93 (100)	1.000
Diabetes mellitus			82 (88)	75 (81)	0.225
Ejection fraction (%) (≥45%)			50.75±3.29	51.28±3.15	0.263
Regional wall motion abnormalities			57 (61)	53 (57)	0.654
Atrial fibrillation			15 (16)	12 (13)	0.677
Ischaemic heart disease			93 (100)	93 (100)	1.000
PTCA			47 (50)	42 (45)	0.557
CABG			19 (20)	14 (15)	0.442
Pacemaker			3 (3)	7 (8)	0.329
Valvular disease			17 (18)	24 (26)	0.288
Left ventricular hypertrophy			46 (49)	38 (41)	0.302
Angiotensin-converting-enzyme inhibitors			55 (59)	62 (67)	0.362
Beta-blockers			67 (72)	61 (66)	0.428
Calcium channels-blockers			38 (41)	43 (46)	0.554
Aspirin			93 (100)	93 (100)	1.000
NYHA	II		45 (48)	52 (56)	0.378
	III		36 (39)	33 (35)	0.761
	IV		12 (13)	8 (9)	0.478
ASA III: IV			65:28	69:24	0.624
Smoking		Smoking	43 (47)	(44) 41	0.882
		Ex-smoking	(17) 16	(25) 23	0.279

Data are presented as mean±SD or numbers (percentages)

PTCA: Percutaneous transluminal coronary angioplasty, CABG: Coronary artery bypass grafting, NYHA: NYHA: New York Heart Association, ASA: American Society of Anesthesiologists Physical Status Score

Table 2: Heart rate and mean arterial blood pressure of patients

Variable		Sevoflurane group (n=93)	Desflurane group (n=93)	P-value
Heart rate (bpm)	T0	81±9	79±10	0.204
	T1	78±8	77±10	0.310
	T2	77±9	75±8	0.108
	T3	79±8	79±8	0.871
	T4	77±8.	78±8	0.527
	T5	75±6	77±7	0.056
	T6	77±6	79±6	0.093
	T7	77±7	78±7	0.259
Mean arterial blood pressure (mmHg)	T0	108±15	106±15	0.447
	T1	107±14	108±17	0.439
	T2	105±13	106±14	0.500
	T3	109±13	111±14	0.252
	T4	108±11	108±10	0.744
	T5	110±12	112±15	0.380
	T6	109±10	109±14	0.628
	T7	112±14	111±13	0.347

Data are presented as mean±SD

T0: the preoperative value, T1: directly after surgery, T2: 6th postoperative hour, T3: 12th postoperative hour, T4: 24th post-operative hour, T5: 2nd postoperative day, T6: 3rd postoperative day, T7: 5th postoperative day.

Table 3 shows the changes in the blood levels of troponin I and creatinine kinase-MB. There were no significant differences in the blood levels of troponin I and creatinine kinase-MB intraoperatively or postoperatively between the two groups.

Table 3: Blood levels of troponin I and creatinine kinase-MB

Variable		Sevoflurane group (n=93)	Desflurane group (n=93)	P-value
Troponin I (ng/ml)	T0	0.69±0,11	0.72±0.12	0.077
	T1	0.70±0.10	0.71±0.11	0.517
	T2	0.74±0.10	0.72±0.14	0.263
	T3	0.81±0.27	0.79±0.30	0.633
	T4	0.90±0.19	0.87±0.35	0.468
	T5	0.86±0.25	0.85±0.21	0.768
	T6	0.79±0.20	0.75±0.18	0.153
	T7	0.72±0.16	0.70±0.15	0.380
Creatinine kinase-MB (ng/ml)	T0	5.43±1.23	5.39±1.20	0.822
	T1	5.48±1.30	5.42±1.27	0.750
	T2	5.52±1.36	5.47±1.40	0.805
	T3	5.59±1.40	5.53±1.44	0.773
	T4	5.64±1.48	5.59±1.50	0.819
	T5	5.60±1.43	5.56±1.44	0.849
	T6	5.52±1.39	5.47±1.37	0.805
	T7	5.46±1.45	5.41±1.40	0.811

Data are presented as mean±SD

T0: the preoperative value, T1: directly after surgery, T2: 6th postoperative hour, T3: 12th postoperative hour, T4: 24th postoperative hour, T5: 2nd postoperative day, T6: 3rd postoperative day, T7: 5th postoperative day.

Table 4 shows the intraoperative data and the outcomes of patients in the two groups.

There were no significant differences regarding the durations of surgery and anesthesia, required ephedrine and dopamine, arterial oxygen saturation, end-tidal $PaCO_2$, hematocrit, intraoperative fluids, transfused packed red blood cells, intraoperative urine output, total dose of fentanyl and atracurium. In both groups, none of the patients had perioperative ECG changes, acute myocardial infarction, congestive heart failure, or pulmonary edema. Postoperative mechanical ventilation was not required and there was no mortality in both groups. There were no significant differences regarding the ICU or hospital lengths of stay.The emergence time (time from the end of anesthesia to the time of opening the eyes spontaneously or the response to verbal commands) was longer in sevoflurane group than desflurane group (P=0.025). The extubation time (duration from end of anesthesia until the patients become fully awake and removal of endotracheal tube) was longer in sevoflurane group than desflurane group (P=0.014). Incidence of emergence cough (coughing during emergence) was not significant between the two groups (P=0.333). The incidence of nausea and vomiting was significantly higher in sevoflurane group than desflurane group (P=0.037).

Table 4: Intraoperative data and outcome of patients

Variables		Sevoflurane group (n=93)	Desflurane group (n=93)	P-value
Type of surgery	Hemicolectomy	5 (5.37)	7 (7.52)	0.765
	Laparoscopic cholecystectomy	14(15.05)	17(18.27)	0.694
	Spine surgery	19(20.43)	14(15.05)	0.442
	Total hip replacement	12(12.90)	8(8.60)	0.477
	Total knee replacement	21(22.58)	26(27.95)	0.499
	Knee joint arthroscopy	9(9.67)	14(15.05)	0.373
	Shoulder joint arthroscopy	7(7.52)	5(5.37)	0.765
	Transurethral resection of prostate	6(6.45)	2(2.15)	0.745
Duration of anesthesia (minutes)		178.24±52.70	175.36±50.59	0.704
Duration of surgery (minutes)		153.65±42.17	148.20±40.90	0.372
Hypertension (SAP≥20% above baseline)		24(25.80)	29(31.18)	0.515
Hypotension (SAP≤20% below baseline)		23(24.73)	26(27.95)	0.739
Tachycardia (HR>100bpm)		19(20.43)	25(26.88)	0.598
Bradycardia (HR<60bpm)		17(18.27)	12(12.90)	0.418
Ephedrine		23(24.73)	26(27.95)	0.739
Dopamine		6(6.45)	10(10.75)	0.432
Arterial oxygen saturation (SPO2) (%)		99.22±019	99.17±0.23	0.979
Partial pressure of carbon dioxide (PaCO2) (mmHg)		35.65±3.29	35.78±3.30	0.788
Hematocrit (%)		35.78±2.16	36.10±2.45	0.346
Total dose of fentanyl (µg)		285.68±56.30	278.10±50.40	0.334
Total dose of atracurium (mg)		165.76±45.80	173.60±53.55	0.284
Fluid's transfusion	Crystalloids (ml)	2190.65±450.40	2097.75±436.60	0.154
	Hesteril 6 %	455.80±81.19	437.36±77.20	0.114
Packed- red blood cells (unit)		1.63±0.38	1.73±0.45	0.103
Intraoperative urine output (ml)		325.25±46.60	316.80±42.36	0.197
Emergence time (minute)		14.55±5.53	12.84±4.80	0.025
Extubation time(minute)		9.20±3.98	7.79±3.82	0.014
Emergence cough		12(12.90)	7(7.52)	0.333
Postoperative nausea and vomiting		19(20.43)	8(8.60)	0.037
Intensive care unit length of stay (days)		2.20±1.01	2.30±1.07	0.513
Hospital length of stay (days)		5.64±2.59	6.10±2.43	0.213

Data are presented as mean±SD or numbers (percentages)

SAP: Systolic arterial blood pressure; HR: Heart rate; ECG: Electrocardiogram

Discussion

There was no definite study compared the cardiac protective effect of sevoflurane and desflurane in patients with ischemic heart diseases undergoing non-cardiac surgery. Most of the previous studies compared the sevoflurane and desflurane either in patients undergoing cardiac surgery or generally evaluated the effect of volatile anesthetic agents in non-cardiac surgery.

The present study showed the sevoflurane and desflurane maintained the hemodynamic stability by minimizing the changes in the heart rate and arterial blood pressure in patients with ischemic heart diseases undergoing non-cardiac surgery, therefore resulted in myocardial protection as shown by the minimal and insignificant changes in the postoperative cardiac enzymes either in comparison to the preoperative levels or between the sevoflurane and desflurane groups. There were no changes in the electrocardiography (ECG), and no cases suffered from acute myocardial infarction. Also, the present study showed no difference in the cardioprotection outcomes provided by the sevoflurane or desflurane. This suggests that sevoflurane or desflurane can be used safely in patients with ischemic heart diseases undergoing non-cardiac surgery.

The volatile anesthetics induce a dose-dependent decrease in myocardial contractility and heart rate. These depressant effects decrease the myocardial oxygen demand and therefore, have beneficial effects on the myocardial oxygen balance during myocardial ischemia.[8] Landoni et al[9] reported that volatile anesthetic agents are protective against myocardial ischemia and reperfusion injury and, therefore volatile anesthetics can be safely used in patients with coronary artery diseases undergoing non-cardiac surgery, and the same results were reported by other studies that showed that volatile anesthetics resulted in decreasing the myocardial infarction, troponin release, hospital length of stay and death,[10-14] especially when sevoflurane or desflurane is used.[15] Also, the volatile anesthetics induce the cardioprotective effect through the pharmacological preconditioning or anesthetic preconditioning.[2] The use of volatile anesthetic agents for hemodynamically stable patients at risk for myocardial ischemia undergoing non-cardiac surgery has recently been recommended as a class of evidence IIA, level B.[16] Some studies showed that sevoflurane and desflurane provided a perioperative myocardial protection as shown by the reduced incidence of myocardial infarction in patients undergoing cardiac surgery, reduced postoperative cardiac troponin, required inotropic support, duration of mechanical ventilation, intensive care unit and hospital length of stay in addition to the decreased incidence of postoperative mortality.[17-19] These findings were confirmed in another study for high-risk elderly patients with documented impaired myocardial function. Sevoflurane and desflurane preserved the myocardial function after cardiopulmonary bypass with less evidence for myocardial damage and better postoperative myocardial function compared with the IV anesthetic agents[20] and the same results were shown by Lafci et al.[21]

The American College of Cardiology/American Heart Association guidelines recommend the use of a volatile anesthetic agent for the maintenance of general anesthesia for patients at risk of myocardial infarction.[22]

Meco et al[23] found that administration of desflurane provides a pharmacological preconditioning, reduces myocardial necrosis and improves the cardiac performance in the postoperative period than the total intravenous anesthesia in patients with ischemic heart diseases undergoing coronary artery bypass graft surgery. Also, the desflurane was associated with a lesser postoperative elevation of biochemical markers of myocardial injury than the total intravenous anesthesia. Contrary to the findings of the present study, some studies reported that the use of the volatile anesthetic agents did not reduce the incidence of myocardial ischemia and major adverse cardiac events in high-risk patients undergoing major non-cardiac surgery compared with the total intravenous anesthetic agents.[1,24-27] Another study showed the myocardial damage measured by cardiac troponin release was not reduced by the sevoflurane during interventional cardiac catheterization.[28] Bignami et al[29] reported that patients with coronary artery disease undergoing mitral valve surgery did not benefit from the cardioprotective effects of sevoflurane and it was not associated to lower the cardiac troponin release when compared with propofol and the same results were documented when desflurane compared with propofol in patients with ischemic heart disease undergoing mitral valve surgery.[30]

In the present study, the emergence and extubation times were significantly longer with sevoflurane than desflurane and these findings are similar with the results of other studies that also showed a rapid recovery after desflurane than sevoflurane anesthesia.[31-35]

The incidence of nausea and vomiting was significantly higher in sevoflurane group than desflurane group and these findings were similar with other studies.[31,36-39]

The major limitation of the current study is the fact that it was not a blinded study.

Conclusion

The sevoflurane and desflurane induces a similar cardioprotective effect in patients with ischemic heart disease undergoing non-cardiac surgery. Sevoflurane and desflurane are associated with minimal changes in the postoperative cardiac enzymes and can be safely used in patients with coronary artery diseases undergoing non-cardiac surgery.

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Conflicts of interest: None.

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