

Effect of desflurane versus sevoflurane on postoperative cardiac biomarkers in older adults undergoing minor- to moderate-risk noncardiac surgery

Nicole Hantakova, MD; Katharina Horvath, MD; Nikolas Adamowitsch, MD; Edith Fleischmann, Prof.; Christian Reiterer, Prof., Alexander Taschner, MD

Department of Anesthesia, General Intensive Care Medicine and Pain Medicine, Medical University of Vienna, Austria

Introduction

Cardiac specific biomarkers are commonly elevated after non-cardiac surgery. (1) Studies have shown that volatile anesthetics exert myocardial protective effects. (2) In contrast to sevoflurane, desflurane additionally mitigated cell death after ischemic reperfusion injury (IRI) in animal trials. (3) Although sevoflunitochondria-drivenrane and desflurane are the most frequently used volatile anesthetics, studies comparing their myocardial protective effects are still limited. Therefore, we conducted a secondary analysis of a prospective randomized clinical trial, comparing the effects of sevoflurane versus desflurane on postoperative Troponin T, NT-proBNP and Copeptin concentrations.

Methods

This is a secondary analysis of a prospective randomized, observer-blinded, single-center clinical trial evaluating the effect of anesthesia with sevoflurane or desflurane on postoperative neurocognitive recovery times in older adults undergoing minor- to moderate-risk noncardiac surgery. Patients were randomized in a 1:1 ratio to receive either desflurane or sevoflurane for maintenance of anesthesia. We performed goal-directed administration of volatile anesthetics with target BIS values of 50±5. Blood parameters for the myocardial evaluation included Troponin T, NT-proBNP, and Copeptin, and were obtained shortly before induction of anesthesia, within one hour after surgery, and on the second postoperative day. Maximum concentrations of cardiac biomarkers were compared between groups using Wilcoxon tests. Difference between baseline and postoperative maximum concentrations of cardiac biomarkers were compared between groups using Mann-Whitney-U-tests.

References

(1) Reiterer C, Kabon B, Taschner A, Falkner von Sonnenburg M, Graf A, Adamowitsch N, Starlinger P, Goshin J, Fraunschiel M, Fleischmann E. Perioperative supplemental oxygen and NT-proBNP concentrations after major abdominal surgery - A prospective randomized clinical trial. J Clin Anesth. 2021 Oct;73:110379. doi: 10.1016/j.jclinane.2021.110379. Epub 2021 Jun 1. Erratum in: J Clin Anesth. 2022 Feb;76:110579. doi: 10.1016/j.jclinane.2021.110579. PMID: 34087659.

(2) Landoni G, Biondi-Zoccai GG, Zangrillo A, Bignami E, D'Avolio S, Marchetti C, Calabrò MG, Fochi O, Guarracino F, Tritapepe L, De Hert S, Torri G. Desflurane and sevoflurane in cardiac surgery: a meta-analysis of randomized clinical trials. J Cardiothorac Vasc Anesth. 2007 Aug;21(4):502-11. doi: 10.1053/j.jvca.2007.02.013. Epub 2007 May 7. PMID: 17678775.

(3) Piriou V, Chiari P, Gateau-Roesch O, Argaud L, Muntean D, Salles D, Loufouat P, Gueugniaud PY, Lehot JJ, Ovize M. Desflurane-induced preconditioning alters calcium-induced mitochondrial permeability transition. Anesthesiology. 2004 Mar;100(3):581-8. doi: 10.1097/0000542-200403000-00018. PMID: 15108972.

Results

This analysis included all 190 patients from May 2022 to April 2023 enrolled in the trial. There was no significant difference between the desflurane and sevoflurane groups in postoperative maximum concentrations of Troponin T (11ng.L⁻¹ [8;16] versus 13ng.L⁻¹ [9;18]; p=0.595), NT-proBNP (196pg.ml⁻¹ [90;686] versus 253pg.ml⁻¹ [134;499]; p=0.288), or Copeptin (19pmol.L⁻¹ [7;58] versus 12pmol.L⁻¹ [6;41]; p=0.096). There was also no significant difference in changes from baseline concentrations to postoperative maximum concentrations between the desflurane versus sevoflurane group (NT-proBNP: 26.0pg.ml⁻¹ [2.1;211.0] versus 45.5pg.ml⁻¹ [2.8;131.0]; p=0.866) (Troponin T: 1.0ng.L⁻¹ [-1.0;3.0] versus 1.0ng.L⁻¹ [-1.0;3.0]; p=0.634) (Copeptin: 7.22pmol.L⁻¹ [1.08;46.26] versus 4.95pmol.L⁻¹ [0.02;25.82]; p=0.237).

Conclusion

We did not observe a significant effect of desflurane versus sevoflurane on maximum postoperative concentrations of Troponin T, NT-proBNP, and Copeptin nor on maximum postoperative changes of Troponin T, NT-proBNP, and Copeptin concentrations from baseline values in older adults undergoing minor- to moderate-risk noncardiac surgery. An explanation for our results might be that cardioprotective effects found in desflurane as compared to sevoflurane, which only have been observed in in-vitro studies, have limited clinically relevant effects after noncardiac surgery. Furthermore, postoperative increases in cardiac biomarkers were overall relatively small, possibly limiting the potential beneficial effect of desflurane in our study population. Further studies, in higher-risk surgeries are therefore needed. Based on our results, it seems likely that the choice of the volatile anesthetic has no significant effect on postoperative cardiac biomarkers in patients undergoing minor- to moderate-risk noncardiac surgery.

	Desflurane (n=95)	Sevoflurane (n=95)	
Age, yrs	73 [70; 80]	73 [70; 78]	
Height, cm	170 [164; 176]	170 [161; 178]	
Weight, kg	75 [66; 86]	77 [66; 87]	
BMI, kg.m ⁻²	26 [23.5; 30.2]	26.3 [23.8; 28.7]	
Sex, n (%)			
Female	44 (46.3)	46 (48.4)	
Male	51 (53.7)	49 (51.6)	
ASA physical status, n (%)			
I-II	52 (54.7)	49 (51.6)	
III	43 (45.3)	46 (48.4)	
Comorbidities, n (%)			
Hypertension	55 (57.9)	57 (60)	
Coronary artery disease	7 (7.3)	9 (9.5)	
Peripheral artery disease	2 (2.1)	4 (4.2)	
Carotid artery stenosis	6 (6.3)	10 (10.5)	
TIA/Stroke	6 (6.3)	3 (3.2)	
Atrial fibrillation	21 (22.1)	12 (12.6)	
COPD	16 (16.8)	11 (11.6)	
Diabetes	18 (18.9)	20 (21.1)	
Hyperlipidemia	33 (34.7)	31 (32.6)	
Smoking < 2 years	17 (17.9)	6 (6.3)	
Maximum postoperative value	Desflurane (n=95)	Sevoflurane (n=95)	p-value
Troponin T (ng.L ⁻¹)	11	13	0.595
NT-proBNP (pg.ml ⁻¹)	196	253	0.288
Copeptin (pmol.L ⁻¹)	19	12	0.096

Table 1: Baseline characteristics are presented as counts (percentages) of patients or median [25th quartile; 75th quartile], ASA (American Society of Anesthesiologists) and maximum postoperative concentrations of cardiac biomarkers.