

## Research Article

# Effect of Perioperative Hypothermia on Anesthetic Outcomes

Tumay Yanaral<sup>1</sup>, and Gokhan Ertugrul<sup>2\*</sup><sup>1</sup>Department of Anesthesiology, Medipol University Hospital, Turkey<sup>2</sup>Department of General Surgery, Medipol University Hospital, Turkey

## Abstract

**Background:** Perioperative hypothermia is a serious complication of general anesthesia. Prevention of perioperative hypothermia may decrease morbidity and mortality. In our study, we investigated the effect of perioperative hypothermia on anesthetic outcomes.

**Material and methods:** Between January 2017 and January 2019 at Medipol University Medical Faculty Hospital, Anesthesiology Department, Istanbul, Turkey, 58 patients with perioperative hypothermia were studied retrospectively. In these patients were divided into two groups; Group 1: Patients with body temperature <35°C. Group 2: Patients body temperature between 35°C-36°C. Between these two groups, factors that may affect perioperative hypothermia and anesthetic outcomes were compared.

**Results:** The mean age was 52.4 years ± 12.3 years. The 30 (51.7%) patients were male and 28 (48.3%) patients were female. Perioperative body temperature was statistically significantly low in elderly patients (0.045). Also in these patients, perioperative transfusion of erythrocyte suspension (0.041) and postoperative shivering (0.076) was statistically significantly more.

**Conclusions:** Prevention of perioperative hypothermia exceptionally important for well anesthetic outcomes. Hypothermia appears to be more common in elderly patients. Need to be more careful in these patients.

**Keywords:** Perioperative hypothermia; Anesthetic outcomes; Analysis

## Introduction

Perioperative hypothermia is a common complication in general anesthesia. General anesthesia causes vasoconstriction of the peripheral vascular, which causes vasodilatation; thus, the patient's body temperature can decrease during the anesthesia [1].

Furthermore, factors such as the patient's age, body mass index, low room temperatures, lack of clothing on the patient, administration of cold intravenous fluids can contribute to perioperative hypothermia [2,3].

Perioperative hypothermia has been associated with greater post anesthetic morbidity and mortality. Especially related to cardiovascular diseases (myocardial ischemia, arrhythmia) and increased blood loss [4-8].

The aim of our study was to evaluate the effect of perioperative hypothermia on anesthetic outcomes.

## Materials and Methods

Between January 2017 and January 2019 at Medipol University Medical Faculty Hospital, Anesthesiology Department, Istanbul,

**Citation:** Yanaral T, Ertugrul G. Effect of Perioperative Hypothermia on Anesthetic Outcomes. Surg Clin J. 2019; 1(1): 1010.

**Copyright:** © 2019 Tumay Yanaral

**Publisher Name:** Medtext Publications LLC

**Manuscript compiled:** August 06<sup>th</sup>, 2019

\***Corresponding author:** Gokhan Ertugrul, Department of General Surgery, Organ Transplantation Center, Medipol University Hospital, TEM Avrupa Otoyolu Goztepe CikiSi No:1, 34214, Bagcilar, Istanbul, Turkey, Tel: +902124607777; Fax: +902124706060; E-mail: mdgertugrul@gmail.com

Turkey, 58 patients with perioperative hypothermia were studied retrospectively. In these patients were divided into two groups; Group 1: Patients with body temperature <35°C. Group 2: Patients body temperature between 35°C-36°C. Between these two groups, factors that may affect perioperative hypothermia and anesthetic outcomes were compared.

## Inclusion-exclusion criteria

Inclusion criteria were age between 18 years and 75 years, American Society of Anesthesiologists (ASA) physical status I-III. Patients had to undergo major open elective surgery under general anesthesia that was scheduled to last over 200 minutes. Exclusion criteria were preoperative body temperature of >38°C or <36°C; known pregnancy or a history of thyroid gland disease.

The operating room temperature was 20°C-22°C in all operation.

## General anesthesia

Patients were premedicated with intravenous midazolam. General anesthesia was induced with propofol and fentanyl followed by vecuronium to facilitate tracheal intubation. Anesthesia was maintained with sevoflurane and remifentanyl titrated to maintain adequate anesthetic depth and hemodynamic stability by clinical monitoring.

All patients were actively warmed during surgery using forced-air with an upper-lower body blanket (3M™ Bair Hugger™ Warming Blanket System. St. Paul, United States Of America).

All intraoperative administered intravenous fluids were warmed to 36°C by an infusion warmer.

## Measurements

Tympanic temperatures were measured with an electronic thermometer (Covidien Genius™ 3 Tympanic Thermometer, Dublin,

Ireland) preoperatively, perioperatively and postoperatively every twenty minutes. A temperature  $<36^{\circ}\text{C}$  was defined as hypothermia. The anesthesia and surgery time duration were recorded.

### Statistical analysis

SPSS 22.0 (SPSS for Windows, 2007, Chicago) was used for statistical analysis. Continuous variables which have normal distribution were presented as mean  $\pm$  Standard deviation. Statistical analysis for the parametric variables was performed by the Student's T-test. The qualitative variables were given as percent and the correlation between categorical variables was investigated by the chi-square test and Fisher's exact test. Statistical significance level was defined as  $p < 0.05$ .

### Results

Mean age of the in patients with body temperature  $<35^{\circ}\text{C}$  were  $54.7 \pm 11.4$  years, in patients with body temperature between  $35^{\circ}\text{C}$ - $36^{\circ}\text{C}$  were  $48 \pm 12.9$  years ( $p:0.045$ ). There were 18 (47.4%) males and 20 (52.6%) females in patients with body temperature  $<35^{\circ}\text{C}$ , there were 10 (50%) males and 10 (50%) females in patients with body temperature between  $35^{\circ}\text{C}$ - $36^{\circ}\text{C}$  were ( $p:0.534$ ).

Mean body mass index of in patients with body temperature  $<35^{\circ}\text{C}$  were  $27.2 \pm 6.1 \text{ kg/m}^2$ , in patients with body temperature between  $35^{\circ}\text{C}$ - $36^{\circ}\text{C}$  were  $29.8 \pm 6.1 \text{ kg/m}^2$  ( $p:0.133$ ).

Mean ASA physical status of in patients with body temperature  $<35^{\circ}\text{C}$  were  $1.4 \pm 0.6$ , in patients with body temperature between  $35^{\circ}\text{C}$ - $36^{\circ}\text{C}$  were  $1.7 \pm 0.6$  ( $p:0.193$ ).

Mean during of operation in patients with body temperature  $<35^{\circ}\text{C}$  were  $302.1 \pm 69.7$  minutes, in patients with body temperature between  $35^{\circ}\text{C}$ - $36^{\circ}\text{C}$  were  $279.1 \pm 55.1$  minutes ( $p:0.205$ ).

Mean during of awakening in patients with body temperature  $<35^{\circ}\text{C}$  were  $18.3 \pm 1.1$  minutes, in patients with body temperature between  $35^{\circ}\text{C}$ - $36^{\circ}\text{C}$  were  $18.7 \pm 1.1$  minutes ( $p:0.330$ ).

There were 15 (39.5%) postoperative shivering in patients with only body temperature  $<35^{\circ}\text{C}$ , There were 3 (15%) postoperative shivering in patients with body temperature between  $35^{\circ}\text{C}$ - $36^{\circ}\text{C}$  ( $p:0.076$ ).

There were not seen myocardial ischemia and arrhythmia in patients with perioperative hypothermia.

Only eight (21.1%) patients with body temperature  $<35^{\circ}\text{C}$  were done transfusion of erythrocyte suspension ( $p:0.041$ ).

Table 1 shows comparison of in patients with body temperature  $<35^{\circ}\text{C}$  and in patients with body temperature between  $35^{\circ}\text{C}$ - $36^{\circ}\text{C}$ .

**Table 1:** Comparison of temperature groups.

	Body Temperature $<35^{\circ}\text{C}$ (n:38)	Body Temperature Between $35^{\circ}\text{C}$ - $36^{\circ}\text{C}$ (n:20)	p
Body Temperature ( $^{\circ}\text{C}$ )	$29.1 \pm 13.1$	$34.2 \pm 5.6$	0.018
Age (Years)	$54.7 \pm 11.4$	$48 \pm 12.9$	0.045
Sex (Male/Female) (n/%)	18 (47.4%)/20 (52.6%)	10 (50%)/10 (50%)	0.534
Body Mass Index ( $\text{kg/m}^2$ )	$27.2 \pm 6.1$	$29.8 \pm 6.1$	0.133
ASA Physical Status	$1.4 \pm 0.6$	$1.7 \pm 0.6$	0.193
During of Operation (Minute)	$302.1 \pm 69.7$	$279.1 \pm 55.1$	0.205
During of Awakening (Minute)	$18.3 \pm 1.1$	$18.7 \pm 1.1$	0.33
Postoperative Shivering (+/-) (n/%)	15 (39.5%)/23 (60.5%)	3 (15%)/17 (85%)	0.076
Transfusion of Erythrocyte Suspension (+/-) (n/%)	8 (21.1%)/30 (78.9%)	- /20 (20%)	0.041

Kg: Kilogram;  $\text{m}^2$ : Square Meters; ASA: American Society of Anesthesiologists

### Discussion

Perioperative hypothermia defines as body temperature  $<36^{\circ}\text{C}$  during operation. Perioperative hypothermia is a common complication in general anesthesia. Perioperative hypothermia incidence is between 10%-90% in elective surgery [9]. In our clinic, perioperative hypothermia incidence is 32% (58 patients).

General anesthesia causes vasoconstriction in the peripheral vascular system, which causes vasodilatation; so, the body temperature can decrease during the anesthesia [1]. Also, factors such as the age, body mass index, low room temperatures, administration of cold intravenous fluids can contribute to perioperative hypothermia [2,3]. In our study, there was perioperative hypothermia statistically significantly more in elderly patients. There were not statistically significant another factor (sex, body mass index, ASA physical status, during operation, operating room temperature) causes of perioperative hypothermia.

Perioperative hypothermia alters the effects of many muscle relaxants and anesthetic drugs. Perioperative hypothermia decreases drug metabolism and can lead to delayed awakening [10,11]. In our study, there were not statistically significant in during of awakening.

Perioperative hypothermia is associated with more postoperative shivering. Postoperative shivering incidence is between 1%-10%. Postoperative shivering reduces patient comfort. Also, postoperative shivering increases oxygen consumption. In these patients, there is an increased risk of cardiac diseases [12,13]. In our study, there were 18 (31%) postoperative shivering in patients with perioperative hypothermia.

Perioperative hypothermia is an important risk factor for cardiovascular diseases (myocardial ischemia, arrhythmia) and increased blood loss [8]. Perioperative hypothermia elevates blood pressure, heart rate, plasma catecholamine concentrations and cardiovascular risk [14]. In our study, there were not seen myocardial ischemia and arrhythmia in patients with perioperative hypothermia.

Perioperative hypothermia disrupts the platelet function, thromboxane B2 synthesis and enzyme functions in the coagulation cascade, thus, increases the risk of blood loss [15]. In our study, only eight (21.1%) patients with body temperature  $<35^{\circ}\text{C}$  were done transfusion of erythrocyte suspension.

Our study has several limitations. First, this study was retrospective. Second, the number of cases was small.

### Conclusion

Despite the limitations described in discussion; Prevention of perioperative hypothermia exceptionally important for well anesthetic outcomes. Hypothermia appears to be more common in elderly

patients. Need to be more careful in these patients for perioperative hemorrhage and postoperative shivering.

## References

1. Kurz A. Physiology of thermoregulation. *Best Pract Res Clin Anaesthesiol.* 2008;22(4):627-44.
2. de Brito Poveda V, Galvao CM, dos Santos CB. Factors associated to the development of hypothermia in the intraoperative period. *Rev Lat Am Enfermagem.* 2009;17(2):228-33.
3. Sessler DI. Temperature monitoring and perioperative thermoregulation. *Anesthesiology.* 2008;109(2):318-38.
4. Campos Suarez JM, Zaballos Bustingorri JM. Hipotermia intraoperatoria no terapéutica: Causas, complicaciones, pre-vención y tratamiento (parte I). *Rev Esp Anesthesiol Reanim.* 2003;50(3):135-44.
5. Zaballos Bustingorri JM, Campos Suarez JM. Hipotermia intraoperatoria no terapéutica: Prevención y tratamiento (parte II). *Rev Esp Anesthesiol Reanim.* 2003;50(4):197-208.
6. Hart SR, Bordes B, Hart J, Corsino D, Harmon D. Unintended perioperative hypothermia. *Ochsner J.* 2011;11(3):259-70.
7. Pearce B, Christensen R, Voepel-Lewis T. Perioperative hypothermia in the pediatric population: prevalence, risk factors and outcomes. *J Anesth Clin Res.* 2010;1(1):1-4.
8. Torossian A, Brauer A, Hocker J, Bein B, Wulf H, Horn EP. Preventing inadvertent perioperative hypothermia. *Dtsch Arztebl Int.* 2015;112(10):166-72.
9. Torossian A, TEMMP (Thermoregulation in Europe Monitoring and Managing Patient Temperature) Study Group. Survey on intraoperative temperature management in Europe. *Eur J Anaesthesiol.* 2007;24:668-75.
10. Lenhardt R, Marker E, Goll V, Tschernich H, Kurz A, Sessler DI, et al. Mild intraoperative hypothermia prolongs postanesthetic recovery. *Anesthesiology.* 1997;87(6):1318-23.
11. Panagiotis K, Maria P, Argiri P, Panagiotis S. Is postanesthesia care unit length of stay increased in hypothermic patients? *AORN J.* 2005;81(2):379-82,385-92.
12. Eberhart LH, Döderlein F, Eisenhardt G, Kranke P, Sessler DI, Torossian A, et al. Independent risk factors for postoperative shivering. *Anesth Analg.* 2005;101(6):1849-57.
13. Yi J, Lei Y, Xu S, Si Y, Li S, Xia Z, et al. Intraoperative hypothermia and its clinical outcomes in patients undergoing general anesthesia: National study in China. *PLoS One.* 2017;12(6):e0177221.
14. Bernard SA, Gray TW, Buist MD, Jones BM, Silvester W, Gutteridge G, et al. Treatment of comatose survivors of out of hospital cardiac arrest with induced hypothermia. *N Engl J Med.* 2002;346(8):557-63.
15. Rajagopalan S, Mascha E, Na J, Sessler DI. The effects of mild perioperative hypothermia on blood loss and transfusion requirement. *Anesthesiology.* 2008;108(1):71-7.