Section: Anaesthesia

Original Research Article

INTRAVENOUS PROPOFOL VS INHALED SEVOFLURANE ON BODY TEMPERATURE DURING GENERAL ANAESTHESIA

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Received : 18/03/2026
Received in revised form : 10/05/2026
Accepted : 25/05/2026

Keywords:
Propofol, Sevoflurane, Core body temperature, peripheral body temperature.

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DOI: 10.47009/jamp.2026.8.3.290

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2026; 8 (3); 1651-1653

ABSTRACT

Background: Fall in body's core and peripheral body temperature is studies and demonstrated previously after general anaesthesia. Intravenous agents are used more for induction of general anaesthesia compared to inhalational agents. Body temperature is essential for regulation of homeostasis. Studies have shown that when propofol is used for general anaesthesia there was more profound fall in core and peripheral body temperature as compared to general anaesthesia induced by sevoflurane. **Materials and Methods:** We adopted a randomised controlled trail where we selected total 50 patients posted for general anaesthesia and randomly allocated two groups with 25 patients each. In group 1 we used propofol and in group 2 we used sevoflurane for induction of general anaesthesia. Core and peripheral body temperature were measured throughout the time and were recorded at interval of 15 minutes. Haemodynamic parameters, quality of recovery, post-operative complications, headache were also recorded. **Result:** It was observed in our study that fall in core and peripheral body temperature was profound in group 2 compared to group 1. The magnitude of temperature gradient was higher for sevoflurane group than that in propofol group. However, there was no significant difference in shivering, incidence of complications, headache during and immediately post-surgery. **Conclusion:** Based on our findings it could be concluded that TCI-propofol and sevoflurane anesthesia caused significant fall in core and peripheral body temperature from their baseline. Fall in core body temperature was comparable between the groups, but fall in peripheral body temperature was significantly more in sevoflurane group.

INTRODUCTION

General anaesthesia inhibits behavioural thermoregulatory compensations, leaving autonomic compensation to offset environmental perturbations which is dose-dependent.[1] It impairs the vasoconstriction threshold about three times as much as the sweating threshold. General anaesthetics linearly increase the warm-response thresholds.[2,3] Intravenous agents are commonly used for induction of anaesthesia in contrast to inhalational agents. Intravenous agents have gained more popularity after its use in the form of Target Controlled Infusion which enables anaesthesiologist to control plasma and effect site concentrations. Among the inhalational agents, sevoflurane has the least incidence of complications and is thus associated with better induction and maintenance.[4]

During general anaesthesia hypothermia is the most common peri-operative finding which results from a combination of anaesthetic impaired thermoregulation and lower threshold to the core temperature, exposure to a cold operating room environment. Normally, heat loss and heat production form an equilibrium allowing a thermal steady state, which keeps core temperature constant. Temperatures of the peripheral tissues are lower than core temperature. Usually, there is a 2ocelsius(C) to 4oC gradient between temperatures in the core and peripheral compartment. Impaired thermo-regulatory control by reducing the vasoconstriction or keeping arterio-venous shunts open at lower core temperatures results on induction of general anaesthesia. Hence, redistribution of body heat results and heat distributes from the core compartment to the peripheral.[5]

Propofol causes profound peripheral vasodilation in contrast to sevoflurane. Vasodilatation in peripheral compartment facilitate core to peripheral heat redistribution and once heat is lost from the core, it cannot be recovered from the periphery because flow of heat up a temperature gradient would violate the second law of thermodynamics.[6-10] In this study we

ISSN (O): 2687-5365; ISSN (P): 2753-6556

hypothesise that both anaesthetic agents produce equal effects on temperature on individuals.

MATERIALS AND METHODS

We adopted a randomised controlled trail where we selected total 50 patients aged in between 18 to 60 years posted for general anaesthesia and randomly allocated two groups with 25 patients each. The study was conducted in anaesthesia department, Mahabodhi Medical College, Gaya, Bihar. Before the start of our study, we took written informed consent from the participants and were informed about the complications and possible outcomes of anaesthesia. In group 1 we used propofol using TCI pump device at 8mcg/ml for plasma concentration and 3-5 mcg/ml for maintenance. In group 2 we used sevoflurane of 1 to 1.5 Iso-MAC concentrations for maintenance of general anaesthesia. Core and peripheral body temperature were measured using two temperature probes throughout the time and were recorded at interval of 15 minutes. Haemodynamic parameters, quality of recovery, post-operative complications, headache were also recorded.

RESULTS

Total of 50 patients, with 25 each in each group were chosen. The socio-demographic parameters are mentioned in [Table 1]. The comparison of core and peripheral body temperature of each group and between group is given below in [Figure 1&2, Table 2,3].

Table 1: Socio-demographic parameters

Sl. No	Socio-demographic parameter	Group 1 (Propofol)	Group 2 (Sevoflurane)
01	Age (in years)	46.53 ± 11.56	49.62 ± 10.73
02	Male gender	11 (44%)	14 (56%)
	Female gender	13 (52%)	12 (48%)
03	BMI (kg/m2)	28.62 ± 7.33	26.53 ± 6.21

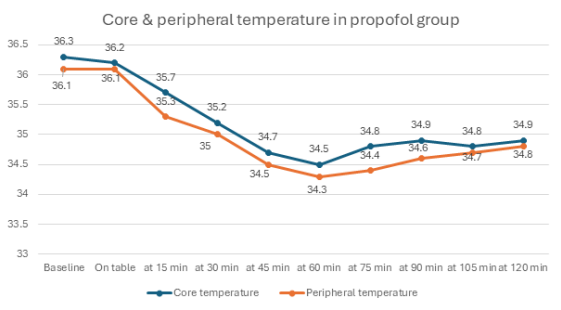

Figure 1: Core and peripheral body temperature in propofol group

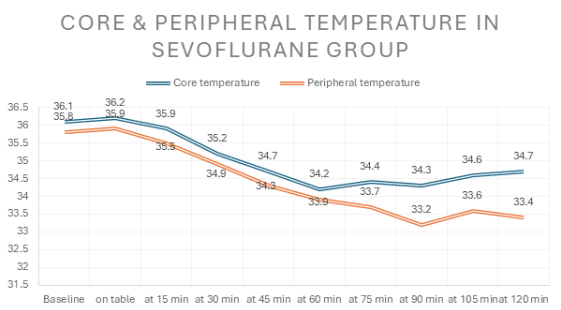

Figure 2: Core and peripheral body temperature in sevoflurane group

Table 2: Comparison of core temperature between group 1 and group 2

Sl. No	Timeline	Core temperature (Propofol)	Core temperature (Sevoflurane)	p value
01	Baseline	36.3 ± 1.11	36.1 ± 1.14	0.5327 NS
02	On table	36.2 ± 1.02	36.2 ± 1.05	1.0000 NS
03	At 15 min	35.7 ± 1.13	35.9 ± 0.99	0.5088 NS
04	At 30 min	35.2 ± 1.09	35.2 ± 0.76	1.0000 NS
05	At 45 min	34.7 ± 1.13	34.7 ± 0.84	1.0000 NS
06	At 60 min	34.5 ± 1.08	34.1 ± 0.78	0.1398 NS
07	At 75 min	34.8 ± 1.07	34.4 ± 1.12	0.2028 NS
08	At 90 min	34.9 ± 0.95	34.3 ± 1.03	0.0374 *
09	At 105 min	34.8 ± 0.76	34.6 ± 0.94	0.4122 NS
10	At 120 min	34.9 ± 1.03	34.7 ± 0.91	0.4704 NS

(t test: NS is not significant, * is significant, at p value <0.05)

Table 3: Comparison of peripheral temperature between group 1 and group 2

Sl. No	Timeline	Peripheral temperature (Propofol)	Peripheral temperature (Sevoflurane)	p value
01	Baseline	36.1 ± 1.22	35.8 ± 1.14	0.3735 NS
02	On table	36.1 ± 1.08	35.9 ± 1.06	0.5119 NS
03	At 15 min	35.9 ± 1.12	35.2 ± 1.02	0.0252 *
04	At 30 min	35.3 ± 1.05	34.7 ± 0.83	0.0297 *
05	At 45 min	34.8 ± 1.27	34.3 ± 0.99	0.1271 NS
06	At 60 min	34.5 ± 0.94	33.9 ± 0.79	0.0183 *
07	At 75 min	34.4 ± 0.89	33.7 ± 0.97	0.0106 *
08	At 90 min	34.6 ± 0.87	33.2 ± 0.81	0.0004 *
09	At 105 min	34.7 ± 1.01	33.6 ± 0.79	<0.0001 *
10	At 120 min	34.8 ± 0.93	33.7 ± 0.82	<0.0001 *

(t test: NS is not significant, * is significant, at p value <0.05)

ISSN (O): 2687-5365; ISSN (P): 2753-6556

DISCUSSION

Matsukawa et al, in their study stated that internal core-to-peripheral redistribution of body heat occurs after induction of general anesthesia. Six minimally clothed male subjects in nearly 22 degrees Celsius environment were studied for 2.5 control hours before and after three hours subsequently after general anesthesia induction. Core temperature was nearly constant during the control period but decreased 1.6 +/- 0.3 degree C in the initial hour of anesthesia. Redistribution contributed 81% to this initial decrease and required transfer of 46 kcal from the trunk to the extremities. During the subsequent 2 h of anesthesia, core temperature decreased an additional 1.1 +/- 0.3 degree C, with redistribution contributing only 43%. Thus, during the second and third hours of anesthesia, only 17 kcal was redistributed. Redistribution therefore contributed 65% to the entire 2.8 +/- 0.5 degree C decrease in core temperature during the 3 h of anesthesia.[11] Ui Jae Im et al, showed that propofol, by blocking thermoregulatory vasoconstriction, caused more severe hypothermia than sevoflurane. Therefore, they studied the induction and maintenance of anesthesia with intravenous propofol to evaluate if it led to more fall in core body temperature than inhaled sevoflurane. They measured the core temperature 8 times, prior to induction and 10, 20, 30, 45, 60, 75 and 90 minutes after induction. Core temperatures decreased in both groups during surgical operation, but there was no significant difference between them. Hence, they concluded as anesthesia by administering propofol did not cause a greater degree of hypothermia than sevoflurane.[12]

K Leslie et al studied the dose-dependent decrease in the thermoregulatory threshold for vasoconstriction of propofol. Increasing propofol concentration produced a linear fall in the vasoconstriction threshold but had little effect on the sweating threshold. Thus, they concluded that propofol reduced the vasoconstriction threshold and increased the inter-threshold range.[13] Atarashi K et al,, studied that sevoflurane decreased threshold for thermoregulatory. They studied 20 patients, aged 20-60 years undergoing open abdominal surgery and concluded that sevoflurane impaired thermoregulation comparably with isoflurane.[14] In a study by Ikheda et al., “less core hypothermia when anaesthesia is induced with inhaled sevoflurane than with intravenous propofol”, conducted in twenty individuals who underwent oral surgery demonstrated that, core temperature decreased significantly more after induction with propofol than with sevoflurane and showed that hypothermia persisted throughout the surgery. This greater difference in propofol induction is attributed to the systemic vasodilation along with blockade of central sympathetic tone.[15]

CONCLUSION

Based on our findings it could be concluded that TCI-propofol and sevoflurane anesthesia caused significant fall in core and peripheral body temperature from their baseline. Fall in core body temperature was comparable between the groups, but fall in peripheral body temperature was significantly more in sevoflurane group. The temperature gradient was more observed in sevoflurane compared to TCI-propofol based anesthesia. It can be said that Sevoflurane caused more hypothermia when compared to TCI-propofol induced anesthesia.

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ISSN (O): 2687-5365; ISSN (P): 2753-6556