

Effectiveness of infusion warmer use to prevent hypothermia and shivering after general anesthesia



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ABSTRACT

Introduction: Shivering and hypothermia after general anesthesia is a common complication in the recovery room. Heating methods and certain drugs are widely used, but may not be effective. The purpose of this study was to evaluate the effectiveness of using infusion warmer in maintaining normal core temperature and prevent shivering after general anesthesia.

Material and Methods: The study was a non-blind randomized control trial study. Research conducted at the Sanglah General Hospital in October 2016. Fifty-eight people met the inclusion and exclusion criteria. They were divided into two groups of 29 patients, Group A (with infusion warmer) and Group B (without infusion warmer). Multiple parameters were recorded: vital signs, hemodynamic,

Aldrete's score, body temperature, and shivering at after induction as well as at 5, 15, 30, 60 post surgery, and at recovery room. The data obtained were analyzed with SPSS software with a significance level of $p < 0.005$, with a relative risk < 1 as significantly preventive.

Results: Hypothermia incidents at 5, 15, 30, and 60 minutes after arrival at recovery room (RR) were significantly different between groups (each p value < 0.001). Shivering incidents at 5, 15, 30, and 60 minutes after arrival at recovery room (RR) were significantly different between groups (p value < 0.018 , < 0.004 , < 0.001 , and < 0.001 respectively). **Conclusions:** The use of infusion warmer may help in reducing the incidence of hypothermia and shivering after general anesthesia.

Keywords: hypothermia, shivering, infusion warmer, general anesthesia.

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INTRODUCTION

Complications after anaesthetic procedure is caused by three factors: anesthesia, surgery, and co-existing diseases. One of many complications seen during recovery after general anaesthesia are hypothermia and shivering. Shivering is an unpleasant condition which usually occur as a complication after both general and regional anaesthesia in patient underwent either elective or emergency surgery.^{1,2,3}

Post-surgical shivering may cause several unwanted complications such as physiological stress, increased oxygen demand by 2-3 times, increased metabolism, increased intracranial and intraocular pressure, elevating carbondioxide production, catecholamine release, and increased post surgical pain.^{4,5,6}

Temperature control at recovery room can be done by using dry blanket to reduce heat evaporation, and the use of warm saline solution. Warm IV saline solution given before, during, and after surgery, is the cheapest and easiest way to maintain core temperature, preventing hypothermia and shivering.^{2,3}

Jie Yi et all (2013) reported that as many as 39% of surgical patients under general anesthesia

experienced intraoperative hypothermia. You Zhi-Jian et all (2011) conducted a study that in those who did not use intravenous fluid warmed in abdominal surgery, the incidence of shivering was 53% ($p < 0,01$), compared to the ones that did use infusion warmer, where there was no shivering reported. This proves warming of intravenous fluids during surgery can prevent shivering in post general anesthesia.^{2,3}

The purpose of this study was to evaluate the effectiveness of using infusion warmer in maintaining normal core temperature and prevent shivering after general anesthesia.

MATERIAL AND METHODS

This research is an experimental non-blind controlled trial design. This research was conducted at the central operating theater at Sanglah General Hospital. The research was conducted in September to October 2016. The target population was all patients who underwent surgery with general anesthesia. The samples who meet eligibility criteria were randomized by permuted block sampling technique.

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The inclusion criteria of this study were: (1) aged 18-60 years; (b) ASA physical status 1-2 (c) body mass index ≥ 18.5 kg / m² or ≤ 24.5 kg / m². While exclusion criteria were: (a) initial temperature $<36,5$ °C or $>37,5$ °C; (b) pregnancy; (c) those who will undergo surgery with a high risk of heat loss; (d) received a transfusion during surgery; and (e) history of frequent nausea and vomiting.

Shivering incidents are classified as Wrench (1997), with 5 scales: 0-4. For the purpose of this research, we classified Wrench's scale of 0-1 as non-shivering, and 2-4 as shivering. Core temperature was measured through the ear canal using digital thermometer. Mild, moderate, and severe hypothermia were classified as ear temperature of 32-35 °C, 27-32 °C, and <27 °C respectively during measurement.

Descriptive analysis aimed to compare the characteristics of the subject by the research group. Chi square test is used for comparing two groups of unpaired and nominal scale. Statistical significance was assessed with p values and 95% confidence intervals. p value of <0.05 was considered significant. Data analysed using SPSS for Windows.

RESULTS

Characteristics of the overall patient data are presented in [table 1](#). We can see from [Table 1](#) that age, body weight, BMI, and room temperature both at OR and RR are normally distributed.

Table 2 Hypothermia incidence after Induction

Hypothermia	Hypothermia		p
	A (warmer) (n = 28)	B (non warmer) (n = 30)	
Moderate	0 (0%)	5 (16,66%)	0,024 ^a
Mild	28 (48,27%)	25 (83,33%)	

Hypothermia incidents are shown in [Table 2](#) and [3](#). Hypothermia incidents at 5, 15, 30, and 60 minutes after arrival at recovery room (RR) were significantly different between groups (each p value <0.001).

Shivering incidents are shown in [Table 4](#). Shivering incidents at 5, 15, 30, and 60 minutes after arrival at recovery room (RR) were significantly different between groups (p value <0.018 , <0.004 , <0.001 , and <0.001 respectively).

DISCUSSION

Hypothermia is defined as a core body temperature <36 °C.^{4,5} Perioperative hypothermia is common and causes severe consequences, one of which is post-surgical shivering. You, Xu, and Cao (2011) at the Department of Anesthesiology of Jiangsu University of China observed that the use of warm fluids in abdominal surgery where both control group and test group had no significantly difference in age, weight, height, gender, ASA, duration of anesthesia, and fluid given. Measurement of core temperature via the tympanic membrane because it's easy, non-invasive, and it has a very small bias $\pm 0,80$ °C compared to esophageal temperature.⁷ In the control group (with intravenous fluids room temperature), core temperature drops to 34,9 °C $\pm 0,3$ °C during the first 3 hours and then stabilized at the end of anesthesia. While the test group (with warmed intravenous fluids) change in core temperature decreases for 60 minutes, then stabilized at the end of anesthesia. The decline in core temperature test group is smaller than the control group. They also reported shivering in 8 patients with score >2 in the control group, while no one was reported shivering in the test group (p <0.01). It showed that warming of intravenous fluids during surgery may prevent shivering after anesthesia and maintain core temperature close to normal.

From the description of characteristic data sample based treatment group ([table 1](#)) shows that the variable weight, BMI, OR temperature, RR temperature, duration of surgery, duration of anesthesia, type of surgery, and gender in both treatment groups after statistical test does not indicate any significant difference (p >0.05), so that the

Table 1 Sample Characteristics

Characteristics	Group		p value
	A (warmer) (n = 29)	B (non warmer) (n = 29)	
Age (years)	34.14 (± 14.64)	54.89 (± 14.42)	0.026 ^a
Body Weight (kg)	159.1 (± 16.32)	21.90 (± 9.05)	0.759 ^a
Body Massa Index (BMI)	22.64 (± 2.95)	21.80 (± 2.58)	0.312 ^a
Temperature at OR (°C)	22.00 (± 0.79)	21.61 (± 0.54)	0.918 ^a
Temperature at RR (°C)	21.84 (± 0.33)	100.93 (± 0.54)	0.049
Duration of surgery (min)	77.24 (± 62.66)	126.79 (± 42.186)	0.239 ^a
Duration of anesthesia (min)	97.76 (± 68.83)	95.87 (± 45.29)	0.158 ^a
Surgery			
Oncology	22 (75.9%)	19 (65.5%)	
ENT	7 (24.1%)	3 (10.3%)	
Orthopedic	0 (0.0%)	7 (24.1%)	0.012 ^b
Sex			
Male	9 (31.0%)	11 (37.9%)	
Female	20 (69%)	18 (62.1%)	0.581 ^b
PONV scale			
Score 0	0 (0.0%)	4 (13.8%)	
Score 1	5 (17.2%)	7 (24.1%)	
Score 2	7 (24.1%)	4 (13.8%)	
Score 3	12 (41.4%)	8 (27.6%)	
Score 4	5 (17.2%)	6 (20.7%)	0.196 ^b

Table 3 Hypothermia incidence at Recovery Room

Minutes after arrival at recovery room	Hypothermia	Hypothermia		p
		A (warmer) (n = 28)	B (non warmer) (n = 30)	
5	Moderate	0 (0%)	18 (60%)	0,001 ^a
	Mild	28 (100%)	12 (40%)	
15	Moderate	0 (0%)	15 (50%)	0,001 ^a
	Mild	28 (100%)	15 (50%)	
30	Moderate	0 (0%)	16 (53,33%)	0,001 ^a
	Mild	28 (100%)	14 (46,66%)	
60	Moderate	0 (0%)	12 (40%)	0,001 ^a
	Mild	28 (100%)	18 (60%)	

Table 4 Shivering incidence in Recovery Room

Minutes after arrival at recovery room	Group	Shivering			p
		Yes (n = 29)	No (n = 29)	RR	
5	A	11 (37,9%)	18 (62,1%)	95% CI (0,325-0,930)	0,018
	B	20 (69,0%)	9 (31,0%)		
15	A	11 (37,9%)	18 (62,1%)	95% CI (0,301-0,832)	0,004
	B	22 (75,9%)	7 (24,1%)		
30	A	3 (10,3%)	26 (89,7%)	95% CI (0,55-0,505)	0,001
	B	18 (62,1%)	11 (37,9%)		
60	A	1 (3,4%)	28 (96,6%)	95% CI (0,010-0,508)	0,001
	B	14 (48,3%)	15 (51,7%)		

research subject is somewhat homogeneous and can be compared.

Table 3 and Table 4 show that the use of warmer can prevent the incidence of shivering and hypothermia in patients after general anesthesia. Warm IV fluids may be given before, during, and after surgery. Warm IV fluids are easy, inexpensive, safe and able to maintain core body temperature, to prevent hypothermia and shivering events.

CONCLUSION

The use of infusion warmer was effective to prevent hypothermia and shivering in patients after general anesthesia. No adverse effects of nausea and vomiting in both treatment groups. Prevention of hypothermia and shivering should be done with multimodal either by pharmacological or non-pharmacological strategies.

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