Poltekita: Jurnal Ilmu Kesehatan
http://jurnal.poltekkespalu.ac.id/index.php/JIK

Vol.17 No.2 August 2023: Hal. 476-486
p-ISSN: 1907-459X e-ISSN: 2527-7170

Original Article

Analysis of Factors Associated with Decreased Body Temperature in the Redistribution Phase, Linear Phase, and Plateau Phase in Spinal Anesthesia Patients in the Central Surgery Installation of Jombang Hospital

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ABSTRACT

Perioperative procedures have the potential to reduce body temperature. Many factors influenced this incident. The study aimed to analyze the factors associated with a decrease in body temperature, analyze the relationship between several factors and a decrease in body temperature, and analyze the factors most associated with a decrease in body temperature in the redistribution phase, linear phase, and plateau phase in spinal anesthesia patients in IBS Jombang Regional Hospital. The research used a Cross-Sectional approach with 70 respondents using the Accidental Sampling technique. The independent variables in the study were age, gender, BMI, type of surgery, duration of surgery, irrigation fluid, ASA score, and comorbidities. The dependent variable includes body temperature in the redistribution, linear, and plateau phases of patients after spinal anesthesia. Data was taken through observations of respondents before surgery and ERM data. Data collection was carried out from February – April 2023. Analysis of the relationship between variables used bivariate Chi-Square analysis with an α value set at <0.05. Analysis of the most related variables uses Multivariate Multiple Linear Regression analysis. The majority of patients experience mild hypothermia in the redistribution phase, linear phase, and plateau phase with a temperature of 34ºC – <36ºC. Factors associated with a decrease in body temperature were age (p = 0.005), type of surgery (p = 0.015), duration of surgery (p = 0.000), ASA score (p = 0.000), and type of irrigation fluid (p = 0.031). The factors gender (p = 0.333), BMI (p = 0.081), and comorbidities (p = 0.494) did not have a significant relationship with decreasing body temperature. The most dominant factors related were the duration of surgery in the redistribution phase (24.2%), linear phase (32.7%), and plateau phase (27.7%). The factors of age, type of surgery, duration of surgery, ASA score, and type of irrigation fluid were related to a decrease in body temperature. In contrast, gender, BMI, and comorbid factors were not related to a decrease in body temperature, and the most dominant factor was the duration of surgery.

Keywords: Decrease in Body Temperature, Factors, Operating Room, Spinal Anesthesia

https://doi.org/10.33860/jik.v17i2.2473

INTRODUCTION

Surgical procedures are a phenomenon that is often found in healthcare settings. The surgical procedure is carried out by making an incision in the area to be operated on. As time goes by, there are developments in the world of health, namely anesthesia. Anesthesia is aimed at minimizing pain and optimizing the patient's condition during surgery [1]. One type of anesthesia is spinal anesthesia. Anesthesia can cause side effects in patients, one of which is hypothermia [2]. Perioperative hypothermia is a clinical challenge for health workers in providing care to post-anesthesia patients. This is because hypothermia often occurs in hospital patients and occurs accidentally [3].

From data from anesthesiologists,

obtained over the last two decades, the incidence of perioperative hypothermia has increased[2]. In a 2021 study in Korea, it was stated that the prevalence of perioperative hypothermia reached 8-90%. The study also stated that 40.6% (268 people) of the 660 respondents in the study experienced hypothermia. Mild hypothermia was experienced by 264 of 268 respondents, and 4 of 268 respondents experienced moderate hypothermia [4]. In Indonesia, the incidence of perioperative hypothermia is not yet known with certainty regarding the incidence. However, several studies state that the incidence of perioperative hypothermia ranges from 50% - 90% in all patients undergoing surgical procedures [5]. The results of a preliminary study by researchers at IBS RSUD Jombang revealed that the average number of patients experiencing hypothermia per month reached 79 patients. So it can be concluded that there are still many cases of hypothermia in patients undergoing surgical procedures. The incidence of hypothermia can be caused by many factors such as age, gender, BMI, type of surgery, duration of surgery, type of irrigation fluid, ASA (American Society of Anesthesiologists) score, and comorbidities[6].

The data above shows the importance of early prevention before hypothermia occurs so as not to cause wider complications such as poor drug metabolism, delayed recovery after anesthesia, longer wound recovery, and decreased body metabolism [7]. This study aimed to determine what factors are associated with a decrease in body temperature in the redistribution phase, linear phase, and plateau phase of spinal anesthesia patients in the Jombang Regional Hospital operating room.

METHOD

This research is a type of quantitative research with a cross-sectional approach where the observation procedure is carried out at one specific time only [8]. The population in this study were patients who underwent surgical procedures with spinal anesthesia at IBS Regional Hospital Jombang from February to April 2023 with an average of 73 patients per month. The research sample was 70 people who were calculated based on the Krejcie and Morgan formula with a sampling technique using non-probability sampling, precisely using the Accidental Sampling method [9]. Samples that are suitable for research are those that meet the inclusion criteria, such as patients who are willing to take part in the study from start to finish, patients who underwent surgery with spinal anesthesia, and patients who experienced hypothermia in the redistribution phase, linear phase, and plateau phase. The criteria for respondents who could not carry out research were respondents who quit or withdrew so they could not continue the research. The independent variables in this study were age, gender, BMI, type of surgery, duration of surgery, irrigation fluid, ASA score, and comorbidities. Meanwhile, the dependent variable in this study is body temperature in the redistribution phase, linear phase, and plateau phase of patients after spinal anesthesia. The instrument needed in this research is an observation sheet to document observation data. Data collection in this study used the method of direct observation of patients when the patient was being weighed before being taken to the operating room. Other data collection is carried out through documentation studies via Electronic Medical Records. Data on age, gender, BMI, duration of surgery, irrigation fluid, ASA score, and comorbidities were measured once. Specifically, the patient's body temperature was measured three times, namely during the redistribution phase, linear phase, and plateau phase. The data collected is then recorded on a research observation sheet.

The analysis in this study used univariate, bivariate, and multivariate analysis. The test for univariate analysis uses frequency distribution data in the form of percentages [10]. Tests for bivariate analysis on eight factors associated with the three phases of decreasing body temperature used the Chi-Square test with an α value set at <0.05. Multivariate test to find out which one is the most influential and the percentage using the Multiple Linear Regression test.

RESULTS

Table 1. Frequency Distribution Table of Respondent Characteristics based on Age, Gender, BMI, Type of Operation, Duration of Operation, ASA Status, Type of Irrigation Fluid, and Comorbidities at IBS RSUD Jombang in February – April 2023

Factor	Frequency (f)	Percentage (%)
Age		
Extreme	49	70 %
Non-Extrem	21	30 %
Gender		
Man	42	60 %
Women	28	40 %
BMI		
Malnutrition	29	41,4 %
Good Nutrition	33	47,1 %
More Nutrition	8	11,4 %
Operation Type		
Major	47	67,1 %
Minor	23	32,9 %
Operation Duration		
Long	20	28,6 %
Currently	41	58,6 %
Fast	9	12,9 %
ASA Score		
ASA 1	33	47,1 %
ASA 2	31	44,3 %
ASA 3	6	8,6 %
Type of Irrigation Fluid		
Ringer Acetate	12	17,1 %
Ringer Lactate	58	82,9 %
Comorbid		
There are comorbid	30	42,9 %
There are no comorbid	40	57,1 %
Total	70	100%

Based on Table 1 above, the results show that the majority of respondents were of extreme age, namely 49 people (70%) with the majority being male, 42 people (60%). Body Mass Index: Nearly half of the respondents, 33 people (47.1%) had good nutritional status. The type of surgery that was most frequently performed was major surgery, 47 people (67.1%), and the most frequent duration was 1 - 2 hours or medium duration with the number of respondents being 41 people (58.6%). Nearly half of the respondents' physical status had an ASA score of 1, 33 people (47.1%). The type of irrigation fluid that is often given is Ringer's lactate fluid with a total of 58 respondents (82.9%), and patients who will undergo surgery do not have comorbid diseases with the number of respondents reaching 40 people (57.1%).

Table 2. Frequency Distribution of Specific Body Temperature Data in the Redistribution Phase, Linear Phase, and Post-Spinal Anesthesia Plateau Phase at IBS RSUD Jombang February – April 2023

Phase	Frequency (f)	Percentage (%)
Redistribution Phase		
Mild Hypothermia	62	88,6 %
Moderate Hypothermia	8	11,4 %
Linear Phase		
Mild Hypothermia	53	75,7 %
Moderate Hypothermia	17	24,3 %
Plateu Phase		
Mild Hypothermia	56	80 %
Moderate Hypothermia	14	20 %
Total	70	100%

Based on Table 2 above, it is known that in the first phase, namely the redistribution phase, the majority of respondents experienced a decrease in body temperature until they experienced mild hypothermia with a temperature of 34ºC – <36ºC, namely 62 people (88.6%). In the linear phase, more respondents experienced a decrease in body temperature, namely 53 people (75.7%). During the plateau phase, almost all respondents experienced mild hypothermia with 56 people (80%).

Table 3. Tabulated Results of Chi-Square Test of Factors with Decrease in Body Temperature in the Redistribution Phase Post Spinal Anesthesia at IBS Jombang Regional Hospital February – April 2023

Variable	Hypothermia Event				Total		p-value
	Mild		Moderate				
	(f)	(%)	(f)	(%)	(f)	(%)	
Age							
Ekntrem	41	58,6%	8	11,4%	49	70%	0,095
Non Extrem	21	30%	0	0	21	30%	
Gender							
Man	38	54,3%	4	5,7%	42	60%	0,705
Women	24	34,3%	4	5,7%	28	40%	
BMI							
Malnutrition	24	34,3%	5	7,1%	29	41,4%	0,384
Good Nutrition	31	44,3%	2	2,9%	33	47,2%	
More Nutrition	7	10%	1	1,4%	8	11,4%	
Operation Type							
Major	39	55,7%	8	11,4%	47	67,1%	0,046
Minor	23	32,8%	0	0	23	32,8%	
Operation Duration							
Long	12	17,1%	8	11,4%	20	28,6%	0,000
Currently	41	58,6%	0	0	41	58,6%	
Fast	9	12,9%	0	0	9	12,9%	
ASA Score							
ASA 1	30	42,9%	3	4,3%	33	47,1%	0,008
ASA 2	29	41,4%	2	2,9%	31	44,3%	
ASA 3	3	4,3%	3	4,3%	6	8,6%	
Type of Irrigation Fluid							
Ringer Acetate	12	17,1%	0	0	12	17,1%	0,335
Ringer Lactate	50	71,4%	8	11,4%	58	82,9%	
Comorbid							
There are komorbic	26	37,1%	4	5,7%	30	42,9%	0,717
There are no komorbid	36	51,4%	4	5,7%	40	57,1%	

Based on Table 3, it was found that in the redistribution phase, the p-value was > 0.05 including the factors age, gender, BMI, type of fluid, and comorbidities meaning that Ha was rejected and H0 was accepted. Other factors such as type of operation, duration of operation, and ASA score have a p-value <0.05, so H0 is rejected and Ha is accepted. It can be concluded that there is a significant relationship between the factors of type of operation, duration of operation, and ASA score with a decrease in body temperature in the redistribution phase of spinal anesthesia patients in the IBS Room at Jombang Regional Hospital.

Table 4. Tabulated Results of Chi-Square Test between Factors and Decrease in Body Temperature in the Linear Phase Post Spinal Anesthesia at IBS RSUD Jombang Month February – April 2023

Variable	Hypothermia Event				Total		p-value
	Mild		Moderate				
	(f)	(%)	(f)	(%)	(f)	(%)	
Age							
Ekntrem	32	45,7%	17	24,3%	49	70%	0,005
Non Extrem	21	30%	0	0	21	30%	
Gender							
Man	34	48,6%	8	11,4%	42	60%	0,333
Women	19	27,1%	9	12,9%	28	40%	
BMI							
Malnutrition	18	25,7%	11	15,7%	29	41,4%	0,081
Good Nutrition	28	40%	5	7,1%	33	47,1%	
More Nutrition	7	10%	1	1,4%	8	11,4%	
Operation Type							
Major	31	44,3%	16	22,9%	47	67,1%	0,015
Minor	22	31,4%	1	1,4%	23	32,9%	
Operation Duration							
Long	5	7,1%	15	21,4%	20	28,5%	0,000
Currently	39	55,7%	2	2,9%	41	58,6%	
Fast	9	12,9%	0	0	9	12,9%	
ASA Score							
ASA 1	28	40%	5	7,1%	33	47,1%	0,000
ASA 2	25	35,7%	6	8,6%	31	44,3%	
ASA 3	0	0	6	8,6%	6	8,6%	
Type of Irrigation Fluid							
Ringer Acetate	12	17,1%	0	0	12	17,1%	0,031
Ringer Lactate	41	58,6%	17	24,3%	58	82,9%	
Comorbid							
There are komorbic							
There are no komorbid	21	30%	9	12,9%	30	42,9%	0,494
	32	45,7%	8	11,4%	40	57,1%	

Based on table 4, it was found that in the redistribution phase, the p-value was > 0.05 including gender, BMI and comorbid factors, meaning that Ha was rejected and H0 was accepted. Other factors such as age, type of operation, duration of operation, type of irrigation fluid and ASA score have a p-value <0.05 so that H0 is rejected and Ha is accepted. It can be concluded that the factors that are significantly related to a decrease in body temperature in the linear phase of spinal anesthesia patients in the IBS Room at Jombang Regional Hospital are age, type of surgery, duration of surgery, type of irrigation fluid, and ASA score.

Table 2. Frequency Distribution of Specific Body Temperature Data in the Redistribution Phase, Linear Phase, and Post-Spinal Anesthesia Plateau Phase at IBS RSUD Jombang February – April 2023

Variable	Hypothermia Event				Total		p-value
	Mild		Moderate				
	(f)	(%)	(f)	(%)	(f)	(%)	
Age							
Extrem	35	50%	14	20%	49	70%	0,007
Non Extrem	21	30%	0	0	21	30%	
Gender							
Man	35	50%	7	10%	42	50%	0,583
Women	21	30%	7	10%	28	40%	
BMI							
Malnutrition	21	30%	8	11,4%	29	41,4%	0,405
Good Nutrition	28	40%	5	7,1%	33	47,1%	
More Nutrition	7	10%	1	1,4%	8	11,4%	
Operation Type							
Major	33	47,1%	14	20%	47	67,1%	0,003
Minor	23	32,9%	0	0	23	32,9%	
Operation Duration							
Long	7	10%	13	18,6%	20	28,6%	0,000
Currently	40	57,1%	1	1,4%	41	58,5%	
Fast	9	12,9%	0	0	9	12,9%	
ASA Score							
ASA 1	28	40%	5	7,1%	33	47,1%	0,000
ASA 2	28	40%	3	4,3%	31	44,3%	
ASA 3	0	0	6	8,6%	6	8,6%	
Type of Irrigation Fluid							
Ringer Acetate	12	17,1%	0	0	12	17,1%	0,107
Ringer Lactate	44	62,9%	14	20%	58	82,9%	
Comorbid							
There are komorbic	23	32,9%	7	10%	30	42,9%	0,763
There are no komorbid	33	47,1%	7	10%	40	57,1%	

Based on Table 5, it was found that in the redistribution phase, the p-value was > 0.05, including the factors gender, BMI, type of fluid, and comorbidities with the meaning that Ha was rejected and H0 was accepted. Other factors such as age, type of operation, duration of operation, and ASA score have a p-value <0.05 so that H0 is rejected and Ha is accepted. It can be concluded that the factors that are significantly related to a decrease in body temperature in the plateau phase of spinal anesthesia patients in the IBS Room at Jombang Regional Hospital are age, type of operation, duration of operation, and ASA score.

Table 6. Table of Multiple Linear Regression Test Results on Factors Associated with Reducing Body Temperature in the Redistribution Phase of Spinal Anesthesia Patients at IBS RSUD Jombang in February – April 2023

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.531[a]	.282	.188	.28877

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.999	8	.250	2.996	.007[b]
	Residual	5.087	61	.083		
	Total	7.086	69			

Coefficients							
Model		**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**	**Zero Order**
		B	**Std. Error**	**Beta**			
1	(Constant)	1.244	0.405		3.067	0.003	
	(X1) Age	-0.046	0.087	-0.066	-0.530	0.598	-0.235
	(X2) Gender	0.071	0.080	0.110	0.892	0.376	0.073
	(X3) BMI	-0.049	0.056	-0.102	-0.882	0.381	-0.108
	(X4) Operation Type	0.104	0.089	0.155	1.160	0.251	0.251
	(X5) Operation Duration	0.254	0.075	0.499	3.389	0.001	0.485
	(X6) Type of Irrigation Fluid	0.026	0.100	0.031	0.260	0.796	0.163
	(X7) ASA Score	0.069	0.076	0.139	0.912	0.365	0.217
	(X8) Comorbid	0.053	0.099	0.083	0.539	0.592	0.052

a. Dependent Variable: Redistribution Phase Patient Temperature

From Table 6 it is known that the Sign value shows 0.007 (< 0.05) and the calculated F value is 2.996 (> F table, namely 2.092), meaning that the eight factors are simultaneously related to a decrease in body temperature. The R-Square value is 0.282, which means the relationship between eight factors simultaneously is 28.2%. Coefficients It is known that the lowest p-value (0.001) and the highest beta coefficient value (0.254) are for the operation duration factor. So it can be concluded that the duration of surgery is the most dominant factor related to reducing body temperature in the redistribution phase with a percentage of the relationship of 24.2% of spinal anesthesia patients at IBS Jombang Regional Hospital.

Table 7. Table of Multiple Linear Regression Test Results on Factors Associated with Decrease in Body Temperature in the Linear Phase of Spinal Anesthesia Patients at IBS RSUD Jombang in February – April 2023

Model Summary				
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
1	.779[a]	.607	.556	.28790

ANOVA[a]						
Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
1	Regression	7.815	8	.977	11.786	.000[b]
	Residual	5.056	61	.083		
	Total	12.871	69			

Coefficients							
Model		**Unstandardized Coefficients**	**Std. Error**	**Standardized Coefficients**	**t**	**Sig.**	**Zero Order**
		B		**Beta**			
1	(Constant)	1.195	0.404		2.957	0.004	
	(X1) Age	-0.147	0.087	-0.157	-1.691	0.096	-0.371
	(X2) Gender	0.228	0.080	0.261	2.859	0.006	0.150
	(X3) BMI	-0.169	0.055	-0.261	-3.045	0.003	-0.246
	(X4) Operation Type	0.025	0.089	0.028	0.285	0.777	0.325
	(X5) Operation Duration	0.342	0.075	0.497	4.568	0.000	0.658
	(X6) Type of Irrigation Fluid	0.075	0.100	0.066	0.752	0.455	0.258
	(X7) ASA Score	0.231	0.076	0.345	3.052	0.003	0.394
	(X8) Comorbid	0.185	0.099	0.213	1.874	0.066	0.115

a. Dependent Variable: Linear Phase Patient Temperature

From Table 7 it is known that the Sign value shows 0.000 (< 0.05) and the calculated F value is 11.786 (> F table) meaning that these eight factors are simultaneously related to a decrease in body temperature. The R-Square value is 0.607, which means the relationship between eight factors simultaneously or together is 60.7%. Coefficients are known to have the lowest p-value (0.000) and the highest beta coefficient value (0.342), namely the operation duration factor. So it can be concluded that the duration of surgery is the most dominant factor related to decreasing body temperature in the linear phase with a percentage of the relationship of 32.7% of spinal anesthesia patients at IBS Jombang District Hospital.

Table 8. Table of Multiple Linear Regression Test Results on Factors Associated with Decreasing Body Temperature in the Plateau Phase of Spinal Anesthesia Patients at IBS RSUD Jombang in February – April 2023

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.699[a]	.489	.422	.30640

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5.473	8	.684	7.288	.000[b]
	Residual	5.727	61	.094		
	Total	11.200	69			

Coefficients[a]

Model		Unstandardized Coefficients	Std. Error	Standardized Coefficients	t	Sig.	Zero Order
		B		Beta			
1	(Constant)	1.176	0.430		2.733	0.008	
	(X1) Age	0.109	0.092	-0.125	1.184	0.241	0.327
	(X2) Gender	0.137	0.085	0.168	-1.615	0.111	0.102
	(X3) BMI	-0.090	0.059	-0.150	-1.535	0.130	-0.151
	(X4) Operation Type	0.034	0.095	-0.041	0.362	0.719	0.350
	(X5) Operation Duration	0.288	0.080	0.449	3.612	0.001	0.618
	(X6) Type of Irrigation Fluid	0.031	0.106	0.030	0.296	0.769	0.227
	(X7) ASA Score	0.220	0.081	0.352	2.731	0.008	0.358
	(X8) Comorbid	0.185	0.105	0.229	1.767	0.082	0.072

a. Dependent Variable: Plateu Phase Patient Temperature

From Table 8 it is known that the Sign value shows 0.000 (< 0.05) and the calculated F value is 7.288 (> f table) meaning that these eight factors are simultaneously related to a decrease in body temperature. The R-Square value is 0.489, which means the relationship between eight factors simultaneously is 48.9%. Coefficients It is known that the lowest p-value (0.001) and the highest beta coefficient value (0.288) are the duration of operation factor which is the most dominant factor associated with a decrease in body temperature in the plateau phase with a relationship percentage of 27.7%.

DISCUSSION

Relationship between Age and Decrease in Temperature

The results of the study show that there is a relationship between age and a decrease in body temperature. The results of this study are in line with Widiyono's research in 2020 regarding the existence of a significant relationship between age and the incidence of hypothermia. This research is also by the theory put forward by [3] regarding extreme age, namely in toddlers, children, and elderly patients who are the age group at risk of experiencing hypothermia in the perioperative period. This is because almost all people in extreme age

categories, one of which is old age, will experience a decline in body condition, whether sick or healthy [11]. The body's strength in carrying out metabolic processes will decrease. Physical conditions such as reduced subcutaneous fat, weakened muscle strength, and thinner skin surface are factors that trigger a decrease in the body's effectiveness in regulating and maintaining the body's thermoregulation.

Relationship between Gender and Decrease in Temperature

Gender and decreased body temperature in spinal anesthesia patients at IBS Jombang Hospital did not have a significant relationship. The results of this study contradict research conducted by Putri Prastiti Mubarokah in 2017 which stated that more women experienced hypothermia than men [12].

Heat absorption from the environment is processed through muscle, skin, fat, and nerve tissue. So if the function of the tissue that is useful for producing body heat is damaged, then body heat production will not be optimal [13]. This damage can occur in both men and women. Another factor that can influence this is the metabolic process. The body's metabolism in women after ovulation can experience an increase marked by an increase in the hormone progesterone, which triggers an increase in basal body temperature.

Relationship between BMI and Temperature Drop

BMI and decreased body temperature in spinal anesthesia patients at IBS Jombang Regional Hospital did not have a significant relationship. The results of this study contradict the theory put forward [1] regarding a low BMI value that will lose heat more easily because it is influenced by thin fat and vice versa. The results of this study also contradict Syulce Luselya Tubalawony's 2023 research regarding the effect of spinal anesthesia on the incidence of post-operative BMI, which shows that BMI is related to the incidence of hypothermia [14].

Patients with a high BMI or body condition with more body weight who have more fat reserves can process fat into body heat energy so they can control cold temperatures. However, in the body, other components can maintain body heat when it is cold, one of which is muscle. Someone with large muscle mass does more physical activity. Muscle mass is not only owned by someone with a high BMI value. A person with a sufficient BMI can also have high muscle mass. These muscles will produce body heat energy to control cold temperatures. Likewise, when someone with large muscle mass experiences hypothermia, their body mechanisms will indirectly direct the muscles to contract like a shivering reflex so that they can produce heat energy to reduce hypothermia [15].

Relationship between Type of Operation and Temperature Drop

The results of this study are by the theory that opening a body cavity such as the stomach during a surgical procedure has an effect on reducing the patient's body temperature [5] and is in line with Dewi Fitriani's 2020 research regarding the type of surgery or type of surgery associated with the incidence of hypothermia. Patients with major surgery will experience more hypothermia than minor surgery [16]. A large enough incision on the surface of the body will cause the skin to lose its role as a temperature controller [17]. Major surgery with a large incision wound means the risk of bleeding will be greater and trigger hypovolemic shock [18]. This results in the blood's ability to absorb and distribute heat throughout the body and the homeostasis process is disrupted. The room temperature in the operating room is quite low, so wide open body surfaces will be exposed to the cold temperature of the room. So body temperature will decrease [19]. Washing the surgical area with unwarmed fluids will increase skin surface contact and cold temperatures which further accelerate the occurrence of hypothermia [20].

Relationship between Operation Duration and Temperature Drop

The duration of surgery and the decrease in body temperature in spinal anesthesia patients at IBS Jombang Regional Hospital have a significant relationship. The results of this study are in line with Syulce Luselya Tubalawony's research in 2023 which stated that the duration of surgery is related to the incidence of hypothermia [14]. Likewise, Heru Nurmansah's research in 2021 also showed that there was a significant relationship between hypothermia and a long duration of surgery [21]. The duration of the operation is calculated from the time the patient is transferred to the operating table and anesthetized until the

patient has finished the operation and will be moved to the recovery room [21]. Hypothermia is caused by the patient being in the operating room with a low temperature. The longer the patient is inside, the more likely changes in body temperature will occur [19].

Relationship between ASA Status and Decrease in Body Temperature

ASA status and decreased body temperature in spinal anesthesia patients at IBS Regional Hospital Jombang have a significant relationship. The results of this study are in line with Suleyman Sari's research in 2020 regarding the ASA score which significantly increases the risk of hypothermia, so it is necessary to monitor temperature during surgery [22].

Unfavorable body conditions will be in the ASA status range 2 and 3. A decline in body condition due to illness or surgical procedures will be followed by a decrease in metabolic rate which makes it easier to reduce body temperature.

Relationship between type of irrigation fluid and decrease in body temperature

Irrigation fluid and decreasing body temperature during spinal anesthesia at IBS at Jombang District Hospital have a significant relationship. Based on the results of Bram's research (2016), Ringer's acetate solution is more effective in preventing hypothermia and shivering in patients undergoing surgery with spinal anesthesia. The metabolic process of ringer acetate occurs in muscles. Muscles are a source of body heat energy which burns more energy than other body organs. Collaboration between metabolic processes and the muscle system, which both play a major role in controlling cold temperatures from outside and processing heat energy within the body, can strengthen the work of Ringer acetate fluid in preventing a decrease in body temperature.

Comorbid Relationship with Decrease in Temperature

Comorbidities and the incidence of decreased body temperature in the redistribution, linear, and plateau phases of spinal anesthesia patients at IBS RSUD Jombang did not have a significant relationship. The results of this study contradict the theory put forward by [3] regarding comorbidities being one of the trigger factors for hypothermia.

The decrease in body temperature that occurs is stronger from internal factors than external factors such as the temperature in the room because almost 80% of people who enter the operating room will experience a decrease in body temperature. Likewise, if other internal factors are added, such as the area of the incision, length of operation, and temperature of the fluid given. This further accelerates the decline in body temperature without distinguishing the characteristics of each person.

Factors Most Associated with Decreased Body Temperature

Based on the results of the analysis, the operation duration factor has a significant influence on reducing body temperature in the redistribution, linear, and plateau phases. Long surgery will affect the preparation for anesthesia and the drugs injected. Of course, the accumulation of drugs with anesthetic agents also increases in the body, which triggers hypothermia. Apart from that, the longer the operation time, the longer the patient stays in the operating room so the time the body is exposed to the low-temperature environment in the operating room will further trigger a decrease in body temperature.

CONCLUSIONS

It can be concluded that there is a relationship between age, type of surgery, duration of surgery, type of irrigation fluid, and the incidence of a decrease in body temperature with the most dominant factor related to this being the duration of surgery. There was no relationship between the factors of gender, BMI, and ASA score with a decrease in body temperature in the redistribution phase, linear phase, and plateau phase in the IBS Room at Jombang Regional Hospital. Suggestions for future researchers are to examine factors related to other post-anesthesia complications such as PONV (Post Operative Nausea Vomiting).

ACKNOWLEDGMENT

The author would like to thank the lecturers who helped guide this writing, as well as the health workers at IBS RSUD Jombang who were willing to help run this research smoothly.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

REFERENCE

1. Kaet S., Senaphati, TA. *Anaesthesia on The Move*. Jakarta: PT Indeks, 2013.
2. Rauch S, Miller C, Bräuer A, Wallner B, Bock M, Paal P. Perioperative hypothermia—a narrative review. International Journal of Environmental Research and Public Health. 2021 Aug 19;18(16):8749.
3. Giuliano KK, Hendricks J. Inadvertent perioperative hypothermia: current nursing knowledge. Aorn Journal. 2017 May 1;105(5):453-63.
4. Cho CK, Chang M, Sung TY, Jee YS. Incidence of postoperative hypothermia and its risk factors in adults undergoing orthopedic surgery under brachial plexus block: A retrospective cohort study. International journal of medical sciences. 2021;18(10):2197.
5. Pratiwi NK, Raya NA, Puspita LM. Manajemen Hipotermia dalam Keperawatan Perioperatif pada Pasien yang Menjalani Pembedahan Abdomen: A Literature Review. Community of Publishing in Nursing (COPING). 2021;9(5):497-506.
6. Rothrock J.C. *Care of the Patient in Surgery 16th Edition*. Elsevier, 2019.
7. Yoo JH, Ok SY, Kim SH, Chung JW, Park SY, Kim MG, Cho HB, Song SH, Cho CY, Oh HC. Efficacy of active forced air warming during induction of anesthesia to prevent inadvertent perioperative hypothermia in intraoperative warming patients: comparison with passive warming, a randomized controlled trial. Medicine. 2021 Mar 26;100(12):e25235.
8. Syamsuni, Rantisari AM. *Statistik dan Metodologi Penelitian Edisi 2*. Yogyakarta: KBM Indonesia, 2021.
9. Eryando T, Sipahutar T, Pratiwi D. *Teori dan Aplikasi Pengumpulan Data Kesehatan*. Yogyakarta: Rapha Publishing, 2017.
10. Siyoto S, Sodik MA. *Dasar Metodologi Penelitian*. Yogyakarta: Literasi Media Publishing, 2015.
11. Malisa, N., Damayanti, D., Z. P. Perdani, YH. Damayanti, Marongka, Suwarno, T., & Nompo RS. *Proses Keperawatan dan Pemeriksaan Fisik*. Medan: Yayasan Kita Menulis, 2021.
12. Putri PM, Titik E, Sari CD. *Faktor-faktor yang berhubungan dengan hipotermi pasca general anestesi di Instalasi Bedah Sentral RSUD Kota Yogyakarta* (Skripsi, Poltekkes Kemenkes Yogyakarta), 2017.
13. Kurniati A, Trisyani Y, Theresia SI. Keperawatan Gawat Darurat dan Bencana Sheehy. Jakarta: Elsevier. 2018.
14. Tubalawony SL, Siahaya A. Pengaruh Anestesi Spinal terhadap Kejadian Hipotermi pada Pasien Post Operasi. Jurnal Keperawatan. 2023 Feb 12;15(1):331-8.
15. Veterini AS, Hamzah H, Semedi BP. *Buku Ajar Teknik Anestesi Umum.* Surabaya: Airlangga University Press, 2021.
16. Sjahdeini SR. Hukum Kesehatan Tentang Hukum Malapraktik Tenaga Medis. IPB Press; 2020.
17. Yulianto NI. Hubungan Lama Operasi Dengan Kejadian Shivering Pada Pasien Post Operative Dengan Spinal Anestesi Di IBS Rumah Sakit Pku Muhammadiyah Yogyakarta, Skripsi thesis, Universitas 'Aisyiyah Yogyakarta.
18. PPNI, *Standar Diagnosis Keperawatan Indonesia Edisi 1*. Jakarta: DPP PPNI, 2017.
19. Black JM, Hawks JH. KMB: Dasar-Dasar Keperawatan Medikal Bedah. Elsevier Health Sciences; 2022 Dec 20.
20. Rehatta NM, Hanindito E, Tantri AR. Anestesiologi dan Terapi Intensif: Buku Teks KATI-PERDATIN. Gramedia pustaka utama; 2019 Sep 16.
21. Nurmansah H, Widodo D, Milwati S. Hubungan Indeks Massa Tubuh, Durasi Operasi Dan Dosis Anestesi Inhalasi Dengan Suhu Tubuh Pada Pasien Post Operasi Dengan General Anestesia Di Recovery Room Rsud Bangil. Journal of Applied Nursing (Jurnal Keperawatan Terapan). 2021;7(2):104-15.
22. Sari S, Aksoy SM, But A. The incidence of inadvertent perioperative hypothermia in patients undergoing general anesthesia and an examination of risk factors. International journal of clinical practice. 2021 Jun;75(6):e14103.