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DETERMINANTS OF POSTOPERATIVE HYPOTHERMIA AMONG PATIENTS RECEIVING GENERAL ANESTHESIA IN A REGIONAL HOSPITAL IN INDONESIA

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Abstract

Postoperative hypothermia remains a common and clinically significant complication among patients undergoing surgery with general anesthesia. This study aimed to identify determinants associated with postoperative hypothermia in patients receiving general anesthesia at RSUD Majalengka, Indonesia. A quantitative analytic observational design with a cross-sectional approach was applied to 91 postoperative patients selected using total sampling. Data were collected from medical records and direct observation, including age, body mass index (BMI), duration of surgery, and postoperative body temperature. Statistical analyses were conducted using univariate, bivariate (Chi-square), and multivariate logistic regression tests. Results showed that 48.4% of patients experienced postoperative hypothermia. Significant associations were found between hypothermia and BMI (p=0.034), duration of surgery (p=0.002), and age (p=0.009). Multivariate analysis revealed that duration of surgery was the most dominant predictor (OR=3.922; p=0.005), indicating patients undergoing longer procedures had nearly four times higher risk of hypothermia. These findings highlight the importance of intraoperative temperature management, particularly in patients undergoing prolonged surgical procedures.

Keywords: Postoperative Hypothermia, General Anesthesia, Duration Of Surgery, Body Mass Index, Age

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INTRODUCTION

Postoperative hypothermia is a common complication among patients undergoing surgery under general anesthesia and remains a major concern in perioperative care. General anesthesia disrupts the body's thermoregulatory mechanisms by causing vasodilation, reducing metabolic heat production, and impairing central temperature control, which leads to a redistribution of heat from the core to peripheral tissues. This condition can occur even in relatively short surgical procedures and may significantly affect patient safety and recovery (Sessler, 2016).

The clinical impact of postoperative hypothermia is substantial and multifactorial. A decrease in core body temperature is associated with increased risk of cardiovascular complications, impaired coagulation, surgical site infections, delayed wound healing, prolonged recovery time, and increased length of hospital stay. Even mild hypothermia can lead to shivering, increased oxygen consumption, and patient discomfort, which may negatively affect postoperative outcomes (Torossian et al., 2015).

Age is one of the most important patient-related factors influencing thermoregulation. Elderly patients are more susceptible to hypothermia due to reduced vasoconstriction response, decreased metabolic rate, and impaired hypothalamic function. These physiological changes limit the body's ability to maintain core temperature when exposed to cold environments, particularly during anesthesia and surgery (Frank et al., 1997).

Body mass index (BMI) also plays a significant role in heat distribution and temperature regulation. Individuals with abnormal BMI, especially those with obesity, may experience altered heat conservation mechanisms and metabolic responses. While adipose tissue can act as insulation, excessive body mass may impair efficient thermoregulation and contribute to uneven heat redistribution during anesthesia (Kurz et al., 1996).

In addition to patient-related factors, procedural characteristics such as duration of surgery strongly influence the occurrence of hypothermia. Longer surgical procedures expose patients to prolonged anesthetic effects, increased heat loss from exposed body surfaces, and sustained environmental cooling in operating rooms. The risk of hypothermia increases progressively with the length of surgery due to continuous redistribution and loss of body heat (Sessler, 2001).

Previous studies have consistently identified duration of surgery as one of the most dominant predictors of perioperative hypothermia. Extended operative time is associated with cumulative heat loss and reduced physiological thermoregulatory response. Therefore, patients undergoing prolonged procedures are at greater risk of developing hypothermia compared to those undergoing shorter operations (Madrid et al., 2016).

In clinical practice, postoperative hypothermia remains prevalent despite advances in anesthetic techniques and perioperative monitoring. Hospital data indicate that a substantial proportion of patients undergoing general anesthesia experience temperature instability during the postoperative period. This highlights the need for early identification of risk factors and implementation of preventive strategies to reduce hypothermia-related complications.

Understanding the determinants associated with postoperative hypothermia is essential for improving perioperative patient safety. Identifying high-risk groups based on age, BMI, and duration of surgery may help healthcare providers implement targeted warming interventions and monitoring strategies. Therefore, this study aimed to analyze factors associated with postoperative hypothermia among patients undergoing surgery with general anesthesia in a regional hospital setting.

METHODS

Study Design

This study employed an analytic observational design with a cross-sectional approach to identify factors associated with postoperative hypothermia among patients receiving general anesthesia. The cross-sectional design was selected to allow simultaneous measurement of exposure variables and outcomes, enabling identification of significant associations between patient characteristics, procedural factors, and the incidence of hypothermia.

Study Setting and Period

The research was conducted at RSUD Majalengka, Indonesia, in 2025. Data collection was carried out

in the postoperative recovery unit and operating room environment. The hospital was selected as the study site due to the high volume of surgical cases performed under general anesthesia, allowing adequate representation of postoperative patients.

Population and Sample

The study population consisted of all patients who underwent surgery using general anesthesia during the study period. Based on hospital records, 91 patients met the eligibility criteria and were included in the study using a total sampling technique. This approach ensured that all accessible and eligible patients were included, minimizing sampling bias and increasing the representativeness of the findings.

Inclusion and Exclusion Criteria

Participants were included if they met the following criteria:

1. Underwent surgery with general anesthesia.
2. Were monitored in the postoperative recovery room.
3. Had complete medical record data relevant to the study variables.

Patients were excluded if they:

1. Had incomplete clinical or temperature monitoring data.
2. Experienced intraoperative complications that could independently affect body temperature regulation.

Variables and Operational Definitions

The dependent variable in this study was postoperative hypothermia, defined as a decrease in body temperature observed after surgery. Body temperature was measured using standard clinical thermometry during the postoperative period and categorized into hypothermia and non-hypothermia groups.

Independent variables included:

- **Age**, categorized into risk and non-risk groups based on clinical vulnerability to temperature dysregulation.
- **Body Mass Index (BMI)**, categorized into normal, overweight, and obese groups according to standard classification.
- **Duration of surgery**, grouped into procedures lasting less than two hours and those lasting two hours or more.

Data Collection Procedure

Data were collected using a structured observation and documentation form. Patient demographic and clinical information, including age, BMI, and duration of surgery, were obtained from medical records. Postoperative body temperature data were collected directly from recovery room monitoring records.

To ensure data quality, all collected data were checked for completeness and accuracy before analysis. Any inconsistencies were verified against the original clinical documentation.

Data Analysis

Data analysis was performed using the Statistical Package for the Social Sciences (SPSS). The analytical process included:

1. **Univariate analysis** to describe the distribution of demographic and clinical variables, presented in frequency and percentage.
2. **Bivariate analysis** using the Chi-square test to assess associations between independent variables (age, BMI, duration of surgery) and postoperative hypothermia incidence.
3. **Multivariate analysis** using logistic regression to determine the most dominant factor associated with postoperative hypothermia while controlling for potential confounding variables.

Statistical significance was determined at a p-value < 0.05, and results were presented as odds ratios (OR) with 95% confidence intervals.

RESULTS AND DISCUSSION

Table 1. Distribution of Respondents Based on Study Variables (n = 91)

Variable	Category	n	%
Postoperative hypothermia	Yes	44	48.4
	No	47	51.6
Age	Risk group	37	40.7
	Non-risk group	54	59.3
Body Mass Index	Normal	33	36.3
	Overweight	36	39.6
	Obese	22	24.2

Duration of surgery	≥ 2 hours	52	57.1
	< 2 hours	39	42.9

Nearly half of the patients (48.4%) experienced postoperative hypothermia, indicating that temperature instability remains a prevalent clinical issue among surgical patients receiving general anesthesia. More than half of the respondents underwent surgical procedures lasting two hours or more (57.1%), which suggests prolonged exposure to anesthetic effects and environmental heat loss. The distribution of BMI showed that a considerable proportion of patients were overweight or obese, potentially contributing to altered thermoregulation.

Table 2. Relationship Between Age and Postoperative Hypothermia

Age Category	Hypothermia (n)	No Hypothermia (n)	p-value
Risk group	Higher proportion	Lower proportion	0.009
Non-risk group	Lower proportion	Higher proportion	

There was a statistically significant association between age and postoperative hypothermia (p = 0.009). Patients categorized as being in the risk-age group were more likely to experience hypothermia compared with younger or non-risk patients. This suggests that physiological aging may impair thermoregulatory responses during surgery.

Table 3. Relationship Between Body Mass Index and Postoperative Hypothermia

BMI Category	Hypothermia (n)	No Hypothermia (n)	p-value
Obese	Higher proportion	Lower proportion	0.034
Overweight	Moderate proportion	Moderate proportion	
Normal	Lower proportion	Higher proportion	

Body Mass Index was significantly associated with postoperative hypothermia (p = 0.034). Patients with abnormal BMI, particularly those classified as obese, showed a higher tendency to develop hypothermia. This finding indicates that variations in body composition may influence heat distribution and metabolic heat conservation.

Table 4. Relationship Between Duration of Surgery and Postoperative Hypothermia

Duration of Surgery	Hypothermia (n)	No Hypothermia (n)	p-value
≥ 2 hours	Higher proportion	Lower proportion	0.002
< 2 hours	Lower proportion	Higher proportion	

Duration of surgery showed a strong and statistically significant association with postoperative hypothermia (p = 0.002). Patients undergoing longer surgical procedures were more likely to experience hypothermia, suggesting that extended exposure to anesthetic effects and operating room conditions increases heat loss.

Table 5. Logistic Regression Analysis of Factors Associated with Postoperative Hypothermia

Variable	OR	p-value	Interpretation
Age	Significant	0.009	Risk factor
BMI	Significant	0.034	Contributing factor
Duration of surgery	3.922	0.005	Most dominant factor

Multivariate logistic regression analysis revealed that duration of surgery was the most dominant predictor of postoperative hypothermia (OR = 3.922; p = 0.005). This indicates that patients undergoing procedures lasting two hours or more were nearly four times more likely to experience

hypothermia compared to those with shorter operative durations.

Age and BMI also remained significant predictors after adjustment, suggesting that both physiological vulnerability and body composition contribute to thermoregulatory instability.

Discussion

The findings of this study indicate that postoperative hypothermia remains a common clinical condition among patients undergoing surgery with general anesthesia, with nearly half of the respondents experiencing a decrease in body temperature during the postoperative period. This result is consistent with previous literature stating that general anesthesia disrupts thermoregulation through vasodilation, reduced metabolic heat production, and redistribution of body heat from the core to peripheral tissues, making patients highly vulnerable to temperature instability during and after surgery (Sessler, 2016).

The significant association between age and postoperative hypothermia found in this study highlights the physiological vulnerability of older patients. Aging is known to impair thermoregulatory function due to reduced vasoconstriction response, decreased metabolic activity, and diminished hypothalamic sensitivity to temperature changes. These factors limit the body's ability to maintain core temperature during surgical exposure and anesthesia, increasing the likelihood of hypothermia among elderly individuals (Frank et al., 1997).

Body mass index (BMI) was also found to be significantly associated with postoperative hypothermia. Variations in body composition can influence heat distribution and thermal insulation. Although adipose tissue may provide some degree of insulation, patients with abnormal BMI may experience altered metabolic heat production and uneven heat redistribution during anesthesia. Previous studies have reported that both underweight and obese patients may have increased susceptibility to perioperative temperature fluctuations (Kurz et al., 1996).

Among the studied variables, duration of surgery emerged as the most dominant predictor of postoperative hypothermia. Patients undergoing procedures lasting two hours or more were significantly more likely to experience a drop in body temperature. Prolonged operative time increases exposure to low ambient temperatures, extends anesthetic effects, and leads to continuous heat loss through evaporation, radiation, and convection. These mechanisms contribute to progressive temperature decline over time (Sessler, 2001).

The strong association between surgical duration and hypothermia supports earlier research emphasizing that the risk of heat loss increases cumulatively with operative time. Longer procedures allow for sustained redistribution hypothermia, which typically occurs during the first hour of anesthesia and continues gradually throughout surgery. Without active warming interventions, core temperature may continue to fall as the duration of anesthesia increases (Madrid et al., 2016).

The findings of this study also reinforce the importance of perioperative temperature monitoring and preventive warming strategies. Maintaining normothermia has been shown to reduce complications such as surgical site infections, cardiovascular events, and delayed recovery. Therefore, patients identified as high risk—particularly older individuals and those undergoing prolonged procedures—should receive targeted temperature management interventions (Torossian et al., 2015).

From a clinical perspective, these results emphasize the critical role of healthcare professionals, particularly nurses and anesthetic teams, in preventing postoperative hypothermia. Continuous monitoring, early detection, and implementation of warming techniques are essential components of perioperative patient safety. Active warming methods such as forced-air warming systems and thermal blankets have been shown to be effective in maintaining core body temperature (NICE, 2016).

The study findings also contribute to strengthening evidence-based practice in perioperative care. By identifying duration of surgery, age, and BMI as significant predictors, healthcare providers can stratify patients according to risk and implement preventive strategies accordingly. Risk-based interventions are essential for improving patient outcomes and reducing complications associated with hypothermia (Butterworth et al., 2018).

Despite the significant findings, this study has limitations that should be considered. The cross-sectional design limits the ability to establish causal relationships, and the study was conducted in a single hospital setting, which may affect generalizability. However, the use of total sampling and multivariate analysis strengthens the internal validity of the results and provides valuable insight into key predictors of postoperative hypothermia (Polit & Beck, 2017).

Overall, this study confirms that postoperative hypothermia is influenced by both patient-related and procedural factors, with duration of surgery being the most dominant determinant. These findings underscore the importance of proactive perioperative temperature management and support the implementation of clinical protocols to prevent hypothermia and improve surgical patient outcomes (Sessler, 2016).

CONCLUSSION

This study concludes that postoperative hypothermia remains frequent among patients receiving general anesthesia, affecting nearly half of the observed cases, and that age, body mass index, and duration of surgery are significantly associated with its occurrence, with surgical duration emerging as the most dominant predictor—patients undergoing procedures lasting ≥2 hours having an approximately fourfold higher risk—therefore emphasizing the need for risk-based perioperative temperature monitoring and active warming strategies, particularly for older patients and those undergoing prolonged surgeries, to reduce hypothermia-related complications and improve postoperative recovery

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