

Age and Body Mass Index Influence Recovery Time of Consciousness After Curettage Under General Anesthesia with Total Intravenous Anesthesia

Siti Aisyah¹, Supriyadi¹, Endiyono¹, Tati Hardiyani¹

¹Faculty of Health Sciences, Universitas Muhammadiyah Purwokerto, Purwokerto, Indonesia

Correspondence: **Supriyadi**: Kampus UMP, Jawa Tengah, Indonesia; priyadiputra@gmail.com

ABSTRACT

Curettage is a gynecological procedure commonly performed under general anesthesia using the total intravenous anesthesia (TIVA) technique; however, recovery time after anesthesia may vary among patients. This variation is influenced by patient characteristics, particularly age and body mass index (BMI). This study aimed to analyze the association between age and body mass index with recovery time in post-curettage patients undergoing general anesthesia with the TIVA technique. This study employed a quantitative method with an observational analytic cross-sectional design conducted in the Post Anesthesia Care Unit of RSU PKU Muhammadiyah Aghisna Kroya. A total of 36 patients were selected using purposive sampling. Data on age and BMI were obtained from medical records, while recovery time was assessed using the Modified Aldrete Score and categorized as fast (≤ 15 minutes) or slow (> 15 minutes). Data analysis was performed using Fisher's Exact Test. The results showed a significant association between age and recovery time ($p < 0.001$) and between BMI and recovery time ($p = 0.007$). This study concludes that patients aged < 35 years and those with normal body mass index ($18.5\text{--}22.9$ kg/m²) tend to experience faster recovery time (≤ 15 minutes), whereas older patients and those with higher body mass index are more likely to experience delayed recovery after curettage under general anesthesia using the TIVA technique.

Keywords: age; body mass index; recovery time; curettage; total intravenous anesthesia

INTRODUCTION

Uterine curettage is a gynecological surgical procedure performed to remove tissue from the uterine cavity. This procedure commonly requires general anesthesia to ensure that patients remain unconscious and pain-free throughout the intervention. One of the general anesthesia techniques widely used for short-duration procedures such as curettage is Total Intravenous Anesthesia (TIVA), which involves administering anesthetic agents exclusively through the intravenous route without the use of inhalational agents. This technique has been reported to provide stable anesthetic depth, faster recovery of consciousness, and a lower incidence of postoperative nausea and vomiting compared with inhalational anesthesia [1]. Several studies also indicate that propofol-based intravenous anesthesia offers superior recovery quality and shorter awakening time than inhalational techniques across various surgical procedures [2,3].

Globally, more than 300 million people undergo anesthesia each year as part of surgical and other medical procedures [4]. The safe anesthesia services are an essential component of healthcare systems because they are directly linked to patient safety and the quality of surgical care [5]. The high volume of anesthesia use underscores the clinical relevance of postoperative recovery issues, including recovery time of consciousness.

Although TIVA is known for its relatively rapid recovery profile, clinical practice still shows considerable variation in awakening time among patients. Recovery time of consciousness is an important indicator of anesthetic success, as prolonged recovery may increase the risk of postoperative complications such as hypoventilation, airway obstruction, and hypoxia, and may also affect the efficiency of services in the Post-Anesthesia Care Unit (PACU) [4,5]. Therefore, identifying factors that influence awakening time is essential to support patient safety and optimize anesthetic care.

Previous studies have demonstrated that patient characteristics contribute to variations in recovery time following general anesthesia. Age is one of the most frequently cited factors associated with delayed awakening. In older adults, the metabolism and elimination of anesthetic agents tend to slow due to reduced hepatic, renal, and central nervous system function, resulting in prolonged anesthetic effects [4,5]. In addition to age, body mass index (BMI) has also been reported to influence the distribution and elimination of anesthetic drugs. Increased adipose tissue in patients with higher BMI may lead to accumulation of lipophilic agents, thereby prolonging anesthetic duration and delaying recovery of consciousness [7-9].

Data from the World Health Organization indicate that the use of general anesthesia in the Asian region reaches approximately 86.74 million cases annually. In Indonesia, the number of surgical procedures is reported to be around 1.2 million cases per year, reflecting the substantial demand for general anesthesia services in clinical practice, with patients presenting diverse age groups and nutritional status profiles [10].

Several previous studies have also reported associations between patient characteristics and recovery time after general anesthesia. Rahe et al. found that increasing age is associated with altered anesthetic dose requirements and longer recovery time following general anesthesia [11]. Other studies have shown that patients who are overweight or obese tend to experience slower anesthetic recovery compared with those with normal BMI due to differences in drug distribution and elimination [12]. However, most of these studies focused on major surgical procedures or used combined inhalational and intravenous anesthetic techniques.

Research specifically examining the relationship between age and BMI and recovery time of consciousness among post-curettage patients receiving general anesthesia with TIVA remains limited, particularly in district-level hospitals. A preliminary study at RSU PKU Muhammadiyah Aghisna Kroya showed variation in awakening time among post-curettage patients, ranging from 5 to 25 minutes. Among 10 observed patients, 4 patients (40%) experienced delayed recovery (> 15 minutes) despite procedure duration of less than 20 minutes, and this condition was more frequently observed in patients aged ≥ 35 years and those with abnormal BMI.

This study offers novelty by specifically evaluating the association between age and BMI and recovery time of consciousness in post-curettage patients receiving TIVA in a district hospital setting, an area that remains underreported in previous research. The findings are expected to provide more specific empirical insights into recovery patterns following curettage and to serve as a basis for developing more individualized postoperative monitoring and anesthetic management strategies.

Therefore, this study aims to analyze the relationship between age and BMI and recovery time of consciousness among post-curettage patients undergoing general anesthesia with TIVA at RSU PKU Muhammadiyah Aghisna Kroya.

METHODS

This study employed a quantitative approach with an analytical observational design using a cross-sectional framework. The research was conducted in the Post-Anesthesia Care Unit (PACU) of RSU PKU Muhammadiyah Aghisna Kroya in November 2025. The study population consisted of all patients undergoing uterine curettage under general anesthesia using the TIVA technique at the same hospital. A total sample of 36 patients was selected through purposive sampling based on predefined inclusion and exclusion criteria.

The inclusion criteria comprised patients aged >18 years, post-curettage patients who received general anesthesia with the TIVA technique at RSU PKU Muhammadiyah Aghisna Kroya, and patients classified as ASA physical status I–II. The exclusion criteria included patients who received regional or combined anesthesia, patients with ASA physical status III–V, and those with medical conditions that could interfere with the assessment of recovery time of consciousness, such as neurological disorders.

The main independent variables in this study were age and BMI, while the dependent variable was recovery time of consciousness. ASA physical status and pre-anesthetic blood pressure were presented as supporting variables that may influence recovery time but were not analyzed as primary independent variables. Age was obtained from medical records and categorized into young (<35 years), middle-aged (35–45 years), and older (>45 years) groups based on clinical considerations in obstetric literature to represent different phases of female reproductive age [13]. BMI was calculated from patients' body weight and height, then classified according to the Asia-Pacific criteria into underweight (<18.5 kg/m²), normal (18.5–22.9 kg/m²), overweight (23–24.9 kg/m²), obesity I (25–29.9 kg/m²), and obesity II (≥30 kg/m²).

Recovery time of consciousness was measured using the Modified Aldrete Score, a standard assessment tool for determining patient readiness for discharge from the recovery room. Recovery time was defined as the duration from the patient's arrival in the PACU until achieving a Modified Aldrete Score ≥9, and was subsequently categorized as fast (≤15 minutes) or slow (>15 minutes). ASA physical status was classified into ASA I and ASA II based on pre-anesthetic evaluation by the anesthesiologist, while pre-anesthetic blood pressure was categorized as normal or abnormal (hypertension or hypotension) based on measurements taken before anesthetic induction.

Data on age, body weight, height, ASA physical status, and pre-anesthetic blood pressure were obtained from patient medical records. General anesthesia was administered using the TIVA technique in accordance with hospital protocols. After the curettage procedure was completed and anesthetic administration was discontinued, patients were transferred to the PACU for monitoring and assessment of recovery time using the Modified Aldrete Score by anesthesia nurses. The collected data were analyzed descriptively to describe respondent characteristics. The associations between age and recovery time, as well as between BMI and recovery time, were analyzed using Fisher's Exact Test due to the relatively small sample size and the presence of cells with expected frequencies below five. The results were presented in frequency distribution tables and cross-tabulations, while ASA physical status and pre-anesthetic blood pressure were presented descriptively without inferential statistical analysis.

RESULTS

A total of 36 post-curettage patients who underwent general anesthesia using the TIVA technique participated in this study. Most respondents were younger than 35 years and had a normal body mass index. Regarding pre-anesthetic physical status, the majority were classified as ASA I and presented with normal pre-anesthetic blood pressure. Most respondents also experienced a rapid recovery of consciousness. The distribution of respondent characteristics is presented in Table 1.

Based on Table 2, bivariate analysis demonstrated a significant association between age and recovery time of consciousness among post-curettage patients receiving general anesthesia with the TIVA technique (Fisher's Exact test, $p < 0.001$). Patients younger than 35 years predominantly experienced rapid recovery, whereas all patients older than 45 years exhibited delayed recovery. These findings indicate that increasing age is associated with slower post-anesthetic recovery of consciousness.

Based on Table 3, bivariate analysis also showed a significant association between BMI and recovery time of consciousness (Fisher's Exact test, $p = 0.007$). Most patients with normal BMI experienced rapid recovery, whereas those in the overweight and obese categories demonstrated a higher proportion of delayed recovery.

In addition to age and BMI, other clinical characteristics such as ASA physical status and pre-anesthetic blood pressure also demonstrated observable trends. Most patients classified as ASA I and those with normal pre-anesthetic blood pressure experienced rapid recovery. Conversely, patients with ASA II status and abnormal pre-anesthetic blood pressure were more frequently found in the delayed recovery group.

DISCUSSION

Table 1. Distribution of demographic characteristics of post-curettage patients

Variable	Category	Frequency	Percentage
Age	Young age (<35 years)	24	66.7
	Middle age (35–45 years)	9	25.0
	Older age (>45 years)	3	8.3
Body Mass Index (BMI)	Underweight (<18.5 kg/m ²)	3	8.3
	Normal (18.5–22.9 kg/m ²)	19	52.8
	Overweight (23–24.9 kg/m ²)	8	22.2
	Obesity I (25–29.9 kg/m ²)	5	13.9
	Obesity II (≥30 kg/m ²)	1	2.8
ASA physical status	I	24	66.7
	II	12	33.3
Pre-anesthetic blood pressure	Normal	25	69.4
	Abnormal	11	30.6
Recovery time	Rapid (≤15 minutes)	28	77.8
	Delayed (>15 minutes)	8	22.2

Table 2. Association between age and recovery time

Age	Rapid recovery ≤15 min	Delayed recovery >15 min	p-value
Young age (<35 years)	23 (95.8)	1 (4.2)	<0.001
Middle age (35–45 years)	5 (55.6)	4 (44.4)	
Older age (>45 years)	0 (0.0)	3 (100.0)	

Table 3. Association between body mass index and recovery time

BMI category	Rapid recovery ≤15 min	Delayed recovery >15 min	p-value
Underweight (<18.5 kg/m ²)	3 (100.0)	0 (0.0)	0.007
Normal (18.5–22.9 kg/m ²)	18 (94.7)	1 (5.3)	
Overweight (23–24.9 kg/m ²)	5 (62.5)	3 (37.5)	
Obesity I (25–29.9 kg/m ²)	2 (40.0)	3 (60.0)	
Obesity II (≥30 kg/m ²)	0 (0.0)	1 (100.0)	

The findings of this study demonstrate that age is significantly associated with recovery time of consciousness among post-curettage patients undergoing general anesthesia with the TIVA technique. Younger patients tended to regain consciousness more rapidly compared with older individuals. This pattern aligns with previous studies reporting that increasing age is consistently linked to prolonged recovery following general anesthesia [11]. Other research has similarly shown that post-anesthetic recovery characteristics are influenced by patient-specific physiological factors, including age-related alterations in organ function and the body's responsiveness to anesthetic agents, which differ substantially in older populations [14].

From a theoretical perspective, the aging process is known to cause progressive declines in physiological reserve, particularly within the cardiovascular, hepatic, and renal systems—organs that play central roles in the metabolism, distribution, and elimination of anesthetic drugs. Reduced cardiac output, diminished hepatic blood flow, and decreased glomerular filtration rate in older adults may slow the clearance of anesthetic agents, thereby prolonging their pharmacological effects and delaying the return of consciousness [8]. These physiological changes provide a plausible explanation for the slower recovery observed in older patients in this study.

Furthermore, several studies have highlighted that aging affects both the pharmacokinetics and pharmacodynamics of anesthetic drugs, including intravenous agents such as propofol. In older patients, the distribution of anesthetic agents tends to be slower, and metabolic pathways may be less efficient, resulting in extended drug action and delayed emergence from anesthesia [12]. Rahe et al. also reported that older adults require different anesthetic dosing strategies and exhibit longer recovery times due to age-related physiological changes that alter drug sensitivity and clearance [11]. Additional evidence suggests that age is a critical determinant of post-anesthetic recovery because central nervous system aging and altered drug metabolism increase susceptibility to anesthetic effects, thereby prolonging the time required to regain consciousness [15].

The association between age and recovery time is also influenced by pre-anesthetic clinical conditions, particularly ASA physical status and pre-anesthetic blood pressure. Older patients often present with higher ASA classifications and impaired hemodynamic regulation, including less stable blood pressure. These conditions reflect reduced physiological reserve and may contribute to slower recovery after anesthesia. Pre-anesthetic instability is known to affect the body's response to anesthetic discontinuation and the speed at which consciousness returns. This finding is consistent with studies reporting a significant relationship between pre-anesthetic physical status and recovery time following general anesthesia [16], as well as anesthetic theory indicating that hemodynamic instability can influence anesthetic drug elimination and delay recovery [17]. Other studies have similarly shown that higher ASA status is associated with increased perioperative risk and delayed emergence due to underlying systemic dysfunction that affects drug metabolism and clearance [18].

In addition to age, this study found that body mass index is significantly associated with recovery time of consciousness in post-curettage patients receiving TIVA. Patients with normal BMI tended to recover more quickly than those with elevated BMI. Previous studies have reported that overweight and obese patients are more likely to experience delayed emergence from general anesthesia [1]. This phenomenon can be explained by the lipophilic nature of many intravenous anesthetic agents, which leads to greater drug sequestration in adipose tissue among individuals with higher BMI, thereby prolonging drug action and delaying recovery [8]. The present findings are consistent with earlier research indicating that overweight and obese patients exhibit slower anesthetic recovery due to increased volume of distribution and prolonged redistribution of anesthetic agents from adipose stores [19,20].

Other studies have also shown that elevated BMI affects both the distribution and elimination of anesthetic drugs, potentially slowing the recovery of consciousness after general anesthesia [21]. This is further supported by evidence that anesthetic agents may accumulate in adipose tissue in obese patients, resulting in prolonged pharmacological effects and delayed emergence [22]. International studies likewise report that overweight and obese individuals tend to experience slower anesthetic recovery due to altered body composition and metabolic disturbances that influence anesthetic pharmacokinetics [23].

The influence of BMI on recovery time is also related to pre-existing clinical conditions, including ASA status and pre-anesthetic blood pressure. Patients with elevated BMI frequently present with cardiovascular comorbidities that may compromise hemodynamic stability during and after anesthesia. Such conditions can impair anesthetic drug elimination and delay the return of consciousness. Several studies have shown that the combination of high BMI and suboptimal pre-anesthetic status contributes to prolonged recovery following general anesthesia [7].

Overall, the findings of this study indicate that age and body mass index are important factors associated with recovery time of consciousness in post-curettage patients undergoing general anesthesia with the TIVA technique. These associations are closely linked to pre-anesthetic clinical conditions, including ASA physical status and pre-anesthetic blood pressure, which collectively influence the recovery process. Therefore, comprehensive pre-anesthetic assessment is essential to support optimal anesthetic planning and facilitate faster recovery of consciousness after the procedure [24].

The findings of this study have practical implications for anesthesia and nursing practice, particularly in pre-anesthetic evaluation and postoperative monitoring of patients undergoing curettage with TIVA. The results underscore the importance of considering patient characteristics—such as age and BMI—when planning anesthesia and monitoring recovery in the post-anesthesia care unit to ensure optimal outcomes.

This study has several limitations. First, the cross-sectional design does not allow for direct causal inference between the variables studied. Second, the sample size was relatively small, and the study was conducted at a single hospital, limiting the generalizability of the findings. Third, this study did not analyze other clinical factors that may influence recovery time, such as anesthetic drug dosage, specific agents used, and procedure duration. Future research should employ stronger study designs with larger sample sizes and incorporate additional clinical variables that may affect post-anesthetic recovery.

CONCLUSION

This study shows that age and body mass index are significantly associated with recovery time after curettage under TIVA general anesthesia. Younger patients and those with normal BMI were more likely to achieve rapid recovery, whereas older individuals and those with overweight or obese BMI demonstrated slower emergence. These patterns reflect underlying physiological and clinical status, including ASA classification and pre-anesthetic blood pressure stability. The findings highlight the need for thorough pre-anesthetic assessment and structured postoperative monitoring, particularly for higher-risk patients. Future studies should adopt stronger designs and include additional clinical variables to better clarify determinants of post-anesthetic recovery.

Ethical consideration, competing interest and source of funding

- This study received ethical approval from the Health Research Ethics Committee of Universitas Muhammadiyah Purwokerto under approval number KEPK/UMP/67/X/2025. All patient data were kept confidential and used solely for research purposes.
- There is no conflict of interest related to this publication.
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