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Original Research

Multivariate Analysis of Mean Arterial Pressure and Physical Status in Post-Laparotomy Nausea and Vomiting

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ABSTRACT

Background: *Mean Arterial Pressure (MAP) and American Society of Anesthesiologists (ASA) physical status are factors that influence the severity of postoperative nausea and vomiting (PONV). Untreated PONV can reduce patient comfort, prolong hospitalization, and pose risks such as dehydration, electrolyte disturbances, surgical wound rupture, and pulmonary aspiration. Assess the stability of organ perfusion during surgery. This study aims to identify factors associated with PONV, which is important for enhancing patient safety and the quality of perioperative care.*

Methods: *This quantitative correlational study employed a cross-sectional design and involved 43 patients recruited using purposive sampling. Bivariate analysis was performed using the Spearman Rank test, while multivariate analysis used ordinal logistic regression. This study utilized respondent observation sheets and the Rhodes INVR instrument, with an instrument validity of 0.87 and a reliability of 0.98.*

Results: *The results indicated that most respondents experienced severe PONV (53.3%). MAP had a significant relationship with PONV (p=0.004; r=–0.402), indicating a moderate negative relationship. ASA status showed a stronger relationship (p<0,001); r=–0.583). Simultaneously, MAP and ASA significantly influenced PONV (χ^2=18.629; (p<0,001) However, in multivariate analysis, only ASA remained significant as a predictor of PONV (p=0.006).*

Conclusion: *There is a significant relationship between Mean Arterial Pressure and American Society of Anesthesiologist physical status with Post Operative Nausea and Vomiting in post laparotomy patients with general anesthesia. This study is useful for monitoring hemodynamic status during surgery to prevent PONV.*

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General anesthesia; laparotomy; mean arterial pressure; postoperative nausea and vomiting; physical status classification system

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INTRODUCTION

Postoperative Nausea and Vomiting (PONV) is one of the most common post-operative complications, especially in patients undergoing major surgery under general anesthesia, including laparotomy. This condition not only reduces patient comfort but

also impacts the quality of recovery, increases the need for antiemetics, prolongs hospitalization, and increases healthcare costs. PONV may cause complications, including electrolyte imbalance, dehydration, aspiration, bleeding, and surgical wound disruption (Karnina & Salmah, 2022; Purwaningsih & Tresya, 2023).

Globally, the number of laparotomies continues to increase annually. The World Health Organization reports that laparotomy procedures are increasing by approximately 10% per year, with an estimated 90 million performed worldwide in 2019 (Faizal, 2024). In Indonesia, laparotomy is among the top five surgical procedures, accounting for 42% of all operations performed (Anwar et al., 2020). However, national recording and reporting of PONV incidence remains limited. Several studies report the incidence of PONV in gynecological laparotomy and mastectomy patients ranging from 30–32%, indicating that PONV remains a significant clinical problem (Nurprayogi & Chasanah, 2023).

PONV incidence is influenced by patient characteristics and perioperative factors. Patient factors include age, gender, smoking history, anxiety, and ASA physical status (Karnina & Salmah, 2022). Perioperative factors include the type and duration of surgery, anesthetic technique, opioid use, and intraoperative hemodynamic stability (Negoro et al., 2025). ASA physical status is widely used to assess preoperative physiological condition and is associated with perioperative outcomes. However, findings on the association between ASA status and PONV incidence and severity remain inconsistent (Zainal et al., 2025; Zamali, 2022).

In addition to ASA physical status, Mean Arterial Pressure (MAP) is an important hemodynamic parameter reflecting organ perfusion during anesthesia and surgery. Decreased MAP, which frequently occurs in patients under general anesthesia, such as the use of propofol, can cause hypotension and reduced tissue perfusion, including the gastrointestinal system and the vomiting center in the brain. Some studies report that low MAP is associated with an increased incidence and severity of PONV, but others have found a tendency for PONV in patients with higher blood pressure. These differing findings indicate a continuing scientific disagreement regarding the role of MAP in PONV (Fariza, 2023; Karlina, 2020).

To date, research simultaneously examining the relationship between Mean Arterial Pressure and ASA physical status and evidence on PONV incidence following laparotomy under general anesthesia remains limite, particularly in Indonesia. Both parameters are important indicators of a patient's physiological readiness and hemodynamic stability during the perioperative period. This limited scientific evidence has the potential to hamper early PONV prevention efforts and optimize the role of nurses in patient monitoring in the recovery room. Accordingly, this study aimed to address the existing knowledge gap and contribute to the development of evidence-based nursing practice. This study aims to analyze the relationship between Mean Arterial Pressure and the physical status of the American Society of Anesthesiologists with the occurrence of PONV in patients after laparotomy surgery under general anesthesia, so that it can identify risk factors for PONV more comprehensively as a basis for increasing clinical awareness, optimizing hemodynamic monitoring, and strengthening evidence-based nursing practice in the recovery room.

MATERIALS AND METHOD

Study Design and Setting

This correlational study falls under the category of research designed to examine the relationship between two or more variables within a quantitative approach (Sudaryana & Agusiadi, 2022). This study is an observational quantitative analytical study with a cross-sectional design. This study employs a cross-sectional approach, an observational research design in which participants are selected based on inclusion and exclusion criteria established by the researcher. All variables are measured simultaneously at a single point in time, thereby enabling the identification of relationships between independent and dependent variables concurrently. The research was conducted at the central surgical installation and post-operative inpatient ward of IHC Lavalette Hospital, Malang on 5-22 November 2025.

Population and Sample

The study population comprised patients undergoing laparotomy under general anesthesia, averaging 65 patients per month. The study sample calculation used the Slovin formula, resulting in 43 respondents. Purposive sampling was used to recruit patients who met the inclusion criteria until the required sample size was reached. Inclusion criteria included patients experiencing mild, moderate, severe, or very severe nausea and vomiting, as well as patients with ASA physical status I–III. Exclusion criteria included patients experiencing worsening conditions or postoperative complications, and patients who refused to be respondents. undergoing laparotomy under general anesthesia, ASA physical status I–III, and willing to be respondents.

Research Variables and Measurements

The independent variables in this study are Mean Arterial Pressure and ASA physical status, while the dependent variable is Postoperative Nausea and Vomiting. Mean Arterial Pressure was obtained from intraoperative blood pressure measurements recorded 15 minutes after incision and calculated using the formula MAP = (systolic + 2 × diastolic) / 3. ASA physical status was classified based on the ASA guidelines. PONV incidence was assessed based on the presence of nausea and/or vomiting that occurred during the observation period in the postoperative inpatient ward. Data were collected using a structured observation sheet containing respondent characteristics, ASA physical status, MAP value, and PONV incidence.

Previous researchers have evaluated the validity and reliability of the Rhodes INVR instrument. Validity testing yielded a correlation coefficient of 0.87; since this value exceeds the 0.3 threshold, the Rhodes INVR instrument is considered valid. A Cronbach's alpha of 0.98 was obtained. An instrument is deemed reliable if the alpha value meets or exceeds the reference value (r-alpha ≥ 0.60); given that 0.98 > 0.60, the Rhodes INVR instrument is considered reliable and suitable for use as a consistent measurement tool (Suseno et al., 2024). This study also utilized an observation sheet; the data collected for each respondent included name, age, gender, diagnosis, type of anesthesia technique, type of anesthetic agent, type of antiemetic medication, history of motion sickness, ASA physical status, and mean arterial pressure (measured pre-anesthesia and 15 minutes post-anesthesia). As for the measurement of MAP, it is performed by the anesthesia team using the anesthesia observation chart.

Statistical Analysis

Data were analyzed descriptively to summarize respondent characteristics and research variable distributions. Bivariate analysis using the Spearman rank test was used to assess the relationship between MAP and ASA physical status with the incidence of PONV. A p-value of <0.05 indicates a significant result, signifying the existence of a relationship between the variables. The strength of the relationship between variables is determined by the coefficient correlation value (Sudaryana & Agusiadi, 2022).

Additionally, the direction of the correlation holds specific significance. A positive (+) correlation indicates that both variables increase together, while a negative (-) correlation indicates an inverse relationship between them (Sudaryana & Agusiadi, 2022). Furthermore, multivariate analysis using an ordinal logistic regression test was conducted to determine the simultaneous effect of MAP and ASA physical status on PONV. Data collection was carried out by processing raw data in Excel and then conducting analysis tests using SPSS.

Ethical Considerations

This study adhered to ethical principles, namely informed consent (providing an explanation of the research and obtaining respondent consent), anonymity (protecting identity by using respondents' initials), confidentiality (refraining from disclosing respondents' personal data), and beneficence (ensuring no interventions were performed on the respondents). An application for ethical clearance was submitted to the Research Ethics Committee of the Health Polytechnic of the Ministry of Health, Malang. The study was granted ethical approval via the Committee Chair's Decree (SK) number DP.04.03/F.XXI.30/01109/2025, dated November 11, 2025.

RESULTS

Respondent Characteristics

Based table 1, nearly half of the respondents (39.5%) were early elderly, aged 44–55 years. All respondents (100%) were female. Nearly half of the respondents (37.5%) were diagnosed with SS TAH BSO. All respondents (100%) were patients using general anesthesia. All respondents (100%) were patients using isoflurane and propofol as anesthetic agents. Most respondents (60.5%) had no history of motion sickness.

Table 1. Distribution of Characteristics of Post-Laparotomy Patients Under General Anesthesia at IHC Lavalette Hospital on 5-22 November 2025 (n = 43)

Characteristics		Frequency (n)	Percentage (%)
Age	Older Teen	2	4.7
	Early Adulthood	1	2.3
	Late Adulthood	14	32.6
	Early Elderly	17	39.5
	Late Elderly	3	7.0
	Seniors	6	14.0
	Total	**43**	**100**
Gender	Female	43	100
	Total	**43**	**100**
Diagnosis	RH	8	18.6
	TAH BSO	11	25.6

Characteristics		Frequency (n)	Percentage (%)
	SS TAH BSO	16	37.2
	SVH BSO	2	4.7
	Omentektomi	2	4.7
	Myomektomi	1	2.3
	Laparotomi	3	7.0
	Total	**43**	**100**
Types of Anesthesia Techniques	General Anesthesia	43	100
	Total	**43**	**100**
Types of Anesthetic Drugs	Isoflurane + Propofol	43	100
	Total	**43**	**100**
History of Motion Sickness	Yes	17	39.5
	No	26	60.5
	Total	**43**	**100**

Note:
RH = Radical Hysterectomy
TAH BSO = Total Abdominal Hysterectomy with Bilateral Salpingo-Oophorectomy
SS TAH BSO = Subtotal/Supracervical Total Abdominal Hysterectomy with Bilateral Salpingo-Oophorectomy
SVH BSO = Simple Vaginal Hysterectomy with Bilateral Salpingo-Oophorectomy

MAP of Post-Laparotomy Patients with General Anesthesia

Based table 2, nearly half of respondents (48.8%) had hypotensive MAP 15 minutes post-incision. Nearly half of respondents (44.2%) had normal MAP 15 minutes post-incision. A small proportion of respondents (7%) had hypertensive MAP 15 minutes post-incision. Most respondents (55.8%) had an American Society of Anesthesiologist physical status of II. Nearly half of respondents (44.2%) had an American Society of Anesthesiologist physical status of III.

Table 2. Mean Arterial Pressure and Physical Status of American Society of Anesthesiologists in Post-Laparotomy Patients Under General Anesthesia at IHC Lavalette Hospital on 05-22 November 2025 (n = 43)

Variables	Category	Frequency (n)	Percentage (%)
MAP 15 Minutes Post Incision	Hypotension	21	48.8
	Normal	19	44.2
	Hypertension	3	7.0
	Total	**43**	**100**
American Society of Anesthesiologists (ASA) Physical Status	II	24	55.8
	III	19	44.2
	Total	**43**	**100**

Post Operative Nausea and Vomitting Post-Laparotomy Patients with General Anesthesia

Based Table 3 , most respondents (53.3%) experienced severe postoperative nausea and vomiting. A small proportion (20.9%) experienced moderate postoperative nausea and vomiting. Nearly half of respondents (25.6%) experienced mild postoperative nausea and vomiting.

Table 3. Post Operative Nausea and Vomiting in Post Laparotomy Patients Under General Anesthesia at IHC Lavalette Hospital on 05-22 November 2025

Variables	Category	Frequency (n)	Percentage (%)
Post Operative Nausea and Vomitting	Mild	11	25.6
	Moderate	9	20.9
	Severe	23	53.3
	Total	**43**	**100**

Cross Tabulation of Characteristics of Respondents With Post-Operative Nausea and Vomiting in Post-Laparotomy Surgery Patients With General Anesthesia at IHC Lavalette Hospital

Based table 4 , the incidence of PONV in this study was dominated by the severe category at 53.5%. Based on age, the group with the largest proportion was the early elderly at 39.53%. All respondents in this study were female (100%), so that all PONV incidents occurred in the female population undergoing gynecological surgery. In terms of diagnostic classification, the group with the highest incidence was SS TAH BSO at 37.21%. The anesthetic technique used in all respondents was general anesthesia (100%), and all patients received a combination of isoflurane and propofol (100%), so that PONV variation was not affected by the type of anesthesia or anesthetic drug. In terms of antiemetic administration, the group that did not receive antiemetics showed the highest percentage at 34.88%.

Based on the history of motion sickness, the group without a history dominated at 60.47%. In terms of ASA physical status, the ASA III group showed the largest proportion at 55.81%, confirming that more severe physiological conditions tend to increase the incidence of PONV. Furthermore, based on the MAP value 15 minutes after incision, the hypotension category was the highest group with 48.84%, indicating that most respondents experienced a decrease in blood pressure which could affect hemodynamic stability and the risk of PONV.

Table 4. Cross Tabulation of Characteristics of Respondents with Post-Operative Nausea and Vomiting in Post-Laparotomy Surgery Patients with General Anesthesia at IHC Lavalette Hospital on 05-22 November 2025

Variables		Mild	Moderate	Severe	Total	%
Age	Older Teen	0	1	1	2	4.65
	Early Adulthood	0	0	1	1	2.33
	Late Adulthood	5	4	5	14	32.56
	Early Elderly	3	2	12	17	39.53
	Late Elderly	2	1	0	3	6.98
	Seniors	1	1	4	6	13.95
Gender	Female	11	9	23	43	100
Diagnosis	RH	3	4	1	8	18.60
	TAH BSO	3	0	8	11	25.58
	SS TAH BSO	4	3	9	16	37.21
	SVH BSO	1	0	1	2	4.65
	OMENTEKTOMI	0	1	1	2	4.65
	MYOMEKTOMI	0	1	0	1	2.33
	LAPAROTOMI	0	0	3	3	6.98
Anaesthetic	General anaesthesia	11	9	23	43	100

Variables		Mild	Moderate	Severe	Total	%
Techniques						
Types of Anesthesia Techniques	Isoflurane + propofol	11	9	23	43	100
Types of Anesthetic Drugs	Ondansentron	3	2	6	11	25.58
	Metoclopramide	3	3	6	12	27.91
	Ranitidine	0	1	4	5	11.63
	No	5	3	7	15	34.88
History of motion sickness	Yes	0	3	14	17	39.53
	No	11	6	9	26	60.47
ASA Physical Status	ASA II	9	6	4	19	44.19
	ASA III	2	3	19	24	55.81
MAP 15 Minutes Post Incision	Hypotension	2	3	16	21	48.84
	Normal	8	6	5	19	44.19
	Hypertension	1	0	2	3	6.98

Relationship Between Mean Arterial Pressure and Postoperative Nausea and Vomiting in Post-Laparotomy Patients With General Anesthesia

Based Table 5, p-value = 0.004 < α (0.05), so H_0 is rejected. This means there is a significant relationship between post-incision Mean Arterial Pressure and Post-Operative Nausea and Vomiting. The correlation coefficient (r) value of -0.402 indicates that the relationship is in the moderate category. The negative sign on the r value indicates that the relationship is in the opposite direction, meaning that the lower the post-incision MAP value, the higher the PONV level tends to be.

The probability value (p-value) = 0.000 <α (0.05), so H_0 is rejected. This means there is a significant relationship between the American Society of Anesthesiologists physical status and Postoperative Nausea and Vomiting. The correlation coefficient (r) value of -0.583 indicates that the relationship is in the moderate to strong category. The negative sign on the r value indicates that the relationship is in the opposite direction, meaning that the higher the ASA physical status category, which indicates a more severe patient condition, the lower the PONV level tends to be.

Table 5. The Relationship Between Mean Arterial Pressure, Physical Status of the American Society of Anesthesiologists and Post-Operative Nausea and Vomiting in Post-Laparotomy Patients Undergoing General Anesthesia at IHC Lavalette Hospital on 05-22 November 2025

Variables	n	p-value	Correlation
MAP 15 Minutes Post Incision Post Operative Nausea and Vomitting	43	0.004	-0,402
American Society of Anesthesiologists Physical Status Post Operative Nausea and Vomitting	43	<0.001	-0,583

The Relationship Between Mean Arterial Pressure and Physical Status of The American Society of Anesthesiologists with Postoperative Nausea and Vomiting in Patients Undergoing Post-Laparotomy Surgery With General Anesthesia

A decrease in the -2 Log Likelihood value between the empty model and the final model resulted in a Chi-Square value of 18.629 with df = 3 and a p value of <0.001. The p value, which is well below 0.05, indicates that the model with the ASA and MAP variables simultaneously provides a significant improvement in model fit. Thus, the null hypothesis (H_0) stating that there is no relationship between MAP and ASA simultaneously with PONV is rejected, and the alternative hypothesis (H1c) is accepted. This indicates that both variables simultaneously contribute to the variation in PONV incidence, although only the ASA variable partially shows a significant relationship.

Table 6. The Relationship Between Mean Arterial Pressure and Physical Status of the American Society of Anesthesiologists and Post-Operative Nausea and Vomiting in Post-Laparotomy Patients Under General Anesthesia at IHC Lavalette Hospital on 05-22 November 2025

Model	-2 Log Likelihood	Chi-Suare	df	p-value
Intercept Only	40.550	-	-	-
Final	21.921	18.629	3	<0.001

DISCUSSION

Mean Arterial Pressure

MAP represents the average arterial pressure throughout a cardiac cycle, derived from systolic and diastolic blood pressure (Angkejaya et al., 2023). Significant changes in MAP were observed 15 minutes after surgical incision, with 48.8% of respondents experiencing hypotension. Researchers believe the decrease in MAP was due to the use of anesthesia, as all respondents (100%) were laparotomy patients undergoing general anesthesia using a combination of inhalational anesthetic (isoflurane) and intravenous anesthetic (propofol). Isoflurane causes peripheral vasodilation by decreasing systemic vascular resistance and myocardial contractility, thus reducing mean arterial pressure in the early stages of surgery (Veterini, 2021). The combination of these two agents causes a sudden decrease in vascular resistance and cardiac output. The results of this study are in line with Adhewibowo's (2024) research which showed that MAP tends to experience a significant decrease after administration of inhalation anesthesia.

American Society of Anesthesiologists Physical Status

The distribution of physical status according to the American Society of Anesthesiologists in this study showed that the majority of respondents were ASA II (55.8%), while 44.2% were ASA III. ASA II physical status describes patients with mild illness without functional limitations, while ASA III physical status refers to patients with one or more moderate to severe illnesses associated with functional limitations. This is consistent with previous research by Fariza (2023), who reported that patients with mild to moderate systemic illnesses more frequently fall into the ASA II category and generally exhibit a more labile physiological response during anesthesia. These findings are relevant because the sympathetic response in ASA II patients remains quite active, potentially leading to greater hemodynamic fluctuations during surgical procedures.

ASA II and ASA III physical statuses reflect differences in physiological reserve and comorbidity burden in patients. Most late-adult patients exhibit decreased cardiovascular compensatory capabilities, including baroreflex sensitivity, vascular

elasticity, and autonomic responses, and are therefore more frequently categorized as ASA II even when their illnesses are under control.

Meanwhile, ASA III patients have more severe systemic disease and lower physiological reserve, but their perioperative stability often appears better due to more conservative anesthetic strategies and closer monitoring (Suyuthi et al., 2024). These results align with research by Wahdana et al., 2024, which showed that patients with higher ASA tend to receive more conservative anesthetic management, including more careful drug titration and close monitoring to maintain physiological stability. Furthermore, research by Sukmawati et al., 2022, found that patients with more severe systemic disease but who received intensive perioperative management may demonstrate better hemodynamic stability during surgery.

Post Operative Nausea and Vomitting

PONV in this study was predominantly severe, with 23 respondents (53.5%), followed by mild PONV (11 respondents (25.6%) and moderate PONV (9 respondents (20.9%). This high rate of severe PONV indicates significant physiological disturbances in the postoperative period. One of the main factors influencing the incidence of PONV is post-incision hemodynamics, with 48.8% of respondents experiencing hypotension. Hypotension causes gastrointestinal hypoperfusion and increases the sensitivity of the vomiting center in the medulla oblongata, thereby increasing the likelihood of nausea and vomiting. This mechanism aligns with research (Adhewibowo, 2024; Fariza, 2023; Wahdana et al., 2024), indicating a significant association between lower MAP and increased PONV incidence.

The researchers believe that female gender also influences the high incidence of severe PONV. Based on the study results, all respondents (100%) were female. This is in line with research by (Karnina & Salmah, 2022), which indicated that female patients undergoing laparotomy under general anesthesia had a 41.8% higher incidence of PONV than male patients at Yogyakarta Regional General Hospital. This may be due to estrogen increasing dopamine receptor sensitivity in the chemoreceptor trigger zone (CTZ), thereby triggering nausea and vomiting (Nurleli et al., 2021).

The study found that the age group at highest risk of PONV was the early elderly (44–54 years). The researchers concluded that age does not influence postoperative nausea and vomiting. These results align with (Cing et al., 2022), which showed that the age group at highest risk of PONV was 50 years old (66.7%), but no differences in the severity of PONV were observed across age groups. The study by (Millizia et al., 2021) also reported that age was not significantly associated with PONV incidence. However, the results of this study contradict research (Karnina & Salmah, 2022) which found a significant association between age and PONV ($p = 0.024$), with the highest incidence occurring among adults aged 25–39 years.

The type of anesthesia and anesthetic agents used also play a significant role in triggering PONV. All respondents underwent general anesthesia using a combination of isoflurane and propofol. Isoflurane is known to increase stimulation of the Chemoreceptor Trigger Zone (CTZ) and trigger increased activity of emetic neurotransmitters, potentially increasing the vomiting response. Although propofol has antiemetic effects, high induction doses can cause cardiovascular depression and worsen hypotension, which in turn increases the likelihood of PONV. The use of intraoperative opioids for analgesia also has an additional emetogenic effect by triggering serotonin release in the gastrointestinal tract.

A history of motion sickness is another factor associated with PONV. The research data showed that 42.5% of respondents had a history of motion sickness. These results align with studies (Millizia et al., 2021; Nurleli et al., 2021), which indicated that a history of motion sickness significantly increases the risk of PONV. The use of antiemetic medications is also an important factor influencing the severity of PONV. The study results showed that nearly half of respondents (37.5%) did not receive antiemetic medication. The effectiveness of antiemetics is influenced by the choice of drug type, combination of antiemetic agents, and timing of administration. If antiemetics are not administered with a multimodal strategy (e.g., using only dopamine antagonists without serotonin antagonists), protection against PONV may be suboptimal, particularly among high-risk patients, such as women with a history of motion sickness or those receiving inhalational anesthetics.

In addition to anesthetic factors, the type of surgery also plays a role. Laparotomy is a major abdominal surgery that involves manipulation of visceral organs. This manipulation increases vagal activity and serotonin release from enterochromaffin cells, thereby enhancing the emetic response. This procedure is also known to carry a higher risk of PONV compared to head, extremity, or skin surgeries due to the direct stimulation of intra-abdominal organs.

The Relationship Between Mean Arterial Pressure and Postoperative Nausea and Vomiting

The study indicated that the MAP values of patients after incision during laparotomy under general anesthesia tended to be unstable. Based on the data obtained, 48.8% of respondents were hypotensive, 44.2% were normal, and 7% were hypertensive. This relatively high proportion of hypotension indicates that laparotomy surgery under general anesthesia affects patient hemodynamic stability. The inhaled general anesthetic used, isoflurane, has a depressant effect on the cardiovascular system through mechanisms such as decreased systemic vascular resistance and decreased myocardial contractility, resulting in a decrease in mean arterial pressure. Inhaled anesthetic agents have the potential to induce hypotension in the early phase of surgery due to peripheral vasodilation and decreased cardiac output.

Propofol can cause hypotension through several simultaneous mechanisms: decreased systemic vascular resistance due to peripheral vasodilation, decreased preload due to venous pooling, and depressed myocardial contractility, which reduces cardiac output. Furthermore, propofol also inhibits the baroreflex response, preventing the body from compensating for increased heart rate when blood pressure drops. The combined effects of vasodilation, decreased venous return, and impaired compensatory mechanisms make propofol one of the anesthetic agents most frequently causing decreased blood pressure, particularly in older adults or patients with low cardiovascular reserve.

Physiologically, MAP is a key determinant in maintaining vital organ perfusion. Decreased MAP causes tissue hypoperfusion, particularly in the central nervous and gastrointestinal system. Gastrointestinal hypoperfusion then stimulates the nausea and vomiting center through activation of the Chemoreceptor Trigger Zone (CTZ) and vagal pathways, thus triggering postoperative nausea and vomiting. Decreased organ perfusion due to hypotension plays a role in increasing the risk of postoperative complications, including PONV.

Based on the study results, researchers concluded that mean arterial pressure is a factor associated with PONV. The bivariate analysis showed a significant correlation (p

= 0.004; r = –0.402), indicating a significant and inverse relationship between post-incision MAP and the incidence of PONV. The lower the MAP value, the higher the severity of PONV. Based on the research results, MAP in the hypotension category showed the largest proportion of severe PONV cases (37.2%). Therefore, the researchers concluded that intraoperative hypotension is a significant contributing factor to the increased incidence of PONV in laparotomy patients undergoing general anesthesia.

The study's results are consistent with previous studies (Adhewibowo, 2024), which found that low MAP (<70 mmHg) was significantly associated with a higher incidence and earlier onset of moderate to severe PONV. This study corroborates these findings by demonstrating that blood pressure imbalances, either hypotension or hypertension, increase susceptibility to PONV due to impaired tissue perfusion. Research by (Karlina, 2020) also reported a significant association between MAP and PONV in post-spinal anesthesia patients, thus identifying MAP as an important predictor of postoperative physiological stability.

The Relationship Between American Society Of Anesthesiologists Physical Status and Postoperative Nausea and Vomiting

The findings demonstrated a significant association between ASA physical status and PONV among patients undergoing laparotomy under general anesthesia. Bivariate analysis revealed a statistically significant, indicating a statistically significant correlation between ASA status and PONV severity. The correlation coefficient of -0.583 indicated an inverse relationship, indicating that the lower the ASA category, the more severe the PONV experienced by the patient.

Cross-distribution data supported this interpretation. In ASA category II, the majority of patients experienced severe PONV (19 patients (44.2%), while only 2 patients (4.7%) were in the mild PONV category and 3 patients (7.0%) were in the moderate PONV category. Conversely, in ASA category III, the majority of patients experienced mild PONV (9 patients; 20.9%) and moderate PONV (6 patients; 14.0%), while only 4 patients (9.3%) experienced severe PONV. This pattern indicates that the group with ASA II had a greater tendency to experience severe PONV than the group with ASA III.

Researchers believe that the higher incidence of PONV in patients with lower ASA is due to a more unstable hemodynamic response to general anesthesia, such as decreased blood pressure and fluctuations in MAP, which disrupt gastrointestinal perfusion and increase CTZ stimulation, triggering nausea and vomiting. This pattern aligns with findings (Fariza, 2023; Wahdana et al., 2024) indicating that hemodynamic instability is associated with a higher risk of PONV. Conversely, patients with higher ASA indicated a lower incidence of PONV because they typically received more controlled anesthetic management, including drug titration and closer monitoring (Sukmawati et al., 2022). Therefore, researchers believe that differences in PONV severity between ASA statuses are influenced not only by underlying medical conditions but also by the physiological stability and quality of anesthetic management provided to each group.

The Relationship Between Mean Arterial Pressure and Physical Status of The American Society of Anesthesiologists with Postoperative Nausea and Vomiting

The findings indicate that MAP 15 minutes after incision and ASA physical status are significantly associated with PONV. Bivariate analysis revealed a significant association between MAP 15 minutes after incision and PONV (p = 0.004; r = –0.402), indicating that the lower the MAP 15 minutes after incision, the more severe the patient's

PONV. Low MAP causes hypoperfusion to the vomiting center in the medulla oblongata and gastrointestinal tract, thereby increasing the sensitivity of the emetic center and triggering more severe nausea and vomiting. MAP <70 mmHg significantly increases the incidence of moderate to severe PONV and accelerates the onset of PONV in postoperative patients (Adhewibowo, 2024). Research (Wahdana et al., 2024) on cesarean section patients also showed consistent results, namely that low MAP is associated with a 72.2% incidence of nausea and vomiting compared to a normal MAP of only 21.4%.

In addition to MAP, this study also found that ASA physical status had a stronger relationship to PONV than MAP. The analysis showed a p-value of 0.000 and a correlation coefficient of -0.583, indicating a moderate to strong relationship and moving in the opposite direction, meaning the lower the ASA category, the more severe the PONV experienced by the patient. Cross-tabulation data supported these results, showing that patients with ASA II had the highest proportion of severe PONV, at 19 (44.2%), while the ASA III group had a higher proportion of mild to moderate PONV. The researchers suggest that patients with lower ASA categories actually exhibit a more unstable physiological response to general anesthesia and surgical procedures, making them more susceptible to severe PONV.

Research by (Zainal et al., 2025) reported that PONV was most common in ASA I patients, at 84.6%, while only 33.3% of ASA III patients experienced PONV. In the multivariate analysis of this study, MAP and ASA variables simultaneously contributed significantly to the incidence of PONV, as demonstrated by a chi-square value of 18.629 and a p-value of 0.000 in the Model Fitting Information (Model Fitting Information). This indicates that the model with both variables had a significantly better fit than the unaffected model. However, parameter analysis revealed that only ASA remained a significant predictor of PONV (p = 0.006), while the effect of MAP became insignificant after being controlled for in the model. This indicates that preoperative physical status is a more dominant factor in determining patient susceptibility to PONV than post-incision MAP fluctuations.

Based on the study results, the researchers concluded that both MAP and ASA play important roles in determining the incidence of PONV, but ASA demonstrated higher predictive power. ASA is directly related to the metabolism and elimination of anesthetic drugs. Patients with higher ASA often have comorbidities such as impaired liver function, kidney disease, and cardiovascular disease, which can slow the metabolism and elimination of anesthetic drugs from the body. This condition causes drug concentrations to remain in the circulation for longer, increasing the likelihood of vomiting center stimulation. Suyuthi et al. (2024) confirmed that impaired organ function in patients with high ASA leads to greater accumulation of anesthetic drugs and a longer duration of exposure, significantly increasing the risk of PONV.

Unlike ASA, the MAP variable only reflects hemodynamic conditions at a specific time point, namely 15 minutes after incision. Therefore, its interpretation is situational and does not represent the overall physiological state. MAP can be influenced by various intraoperative factors such as anesthetic dose, fluid management, vasopressor use, and surgical technique, making its value more easily modified by anesthetic intervention. Patients with higher ASA generally also receive closer monitoring and more aggressive hemodynamic correction during surgery, allowing MAP fluctuations to be controlled more quickly. These findings are consistent with previous research that intraoperative blood pressure changes can be stabilized through anesthetic intervention, thus reducing its influence on PONV incidence compared to the more fundamental and non-modifiable

influence of ASA status (Wahdana et al., 2024). This study is valuable for optimizing hemodynamic monitoring and interprofessional collaboration, particularly in the operating room. It can also serve as a reference for future researchers, who might incorporate clinical variables—such as the type and dosage of anesthetic agents, opioid use, and surgical techniques and duration—as well as individual patient factors, including a history of motion sickness, anxiety, and prior PONV.

CONCLUSION

Based on the study findings and discussion, it can be concluded that MAP and ASA physical status are significantly associated with PONV in patients undergoing laparotomy under general anesthesia, where simultaneously both variables influence PONV, but in multivariate analysis only the physical status of the ASA is proven to be the dominant predictor, so that the physical condition of the preoperative patient has an important role in the severity of PONV. Therefore, nurses and health workers are expected to conduct a comprehensive assessment of ASA status and strict hemodynamic monitoring, especially MAP, as an effort to prevent and manage post-operative PONV, while health care institutions can utilize these findings as a basis for strengthening the standard operating procedures for post-anesthesia care.

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