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ORIGINAL ARTICLE

Association Between Preoperative Anxiety Level and Increased Blood Pressure and Pulse Rate Among Surgical Patients: A Cross-Sectional Study

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ABSTRACT

Background: Preoperative anxiety is a common psychological response among surgical patients and may be accompanied by hemodynamic changes, including increased blood pressure and pulse rate. These changes may complicate preoperative preparation and affect perioperative stability.

Objectives: This study aimed to examine the association between preoperative anxiety level and increased blood pressure and pulse rate among surgical patients.

Methods: A quantitative observational study with a cross-sectional design was conducted at PKU Muhammadiyah Yogyakarta Hospital, Indonesia. A total of 55 first-time surgical patients aged 17–59 years who were scheduled for elective surgery under general anaesthesia were selected using purposive sampling. Preoperative anxiety was assessed using the Indonesian version of the Amsterdam Preoperative Anxiety and Information Scale, while blood pressure and pulse rate were measured using a calibrated digital sphygmomanometer. Data were analysed using Spearman's rank correlation test.

Results: Moderate anxiety was the most common category, reported by 25 participants (45.5%). Prehypertension was observed in 37 participants (67.3%), and tachycardia was identified in 36 participants (65.5%). Preoperative anxiety level was significantly and positively associated with blood pressure category ($\rho = 0.654$, $p < 0.001$) and pulse-rate category ($\rho = 0.515$, $p < 0.001$).

Conclusions: Higher preoperative anxiety levels were associated with higher blood pressure and pulse-rate categories among patients undergoing elective surgery. Routine anxiety screening alongside hemodynamic monitoring may support more comprehensive preoperative assessment and psychological preparation.

Introduction

Surgical procedures are an essential component of modern health care because they support diagnosis, treatment, restoration of function, and prevention of life-threatening complications. Global data show that surgical volume is high worldwide, with hundreds of millions of procedures performed annually, making perioperative safety a major public health priority (Weiser et al., 2016). As surgical volume increases, preoperative assessment must address not only physical readiness but also psychological factors that may influence perioperative stability and recovery (Bello et al., 2025; Shebl et al., 2025). Among these psychological factors, preoperative anxiety is particularly important because it can affect patient comfort, physiological responses, anesthetic management, and surgical outcomes (Baagil et al., 2023; Shebl et al., 2025).

Preoperative anxiety is commonly described as a subjective feeling of fear, tension, nervousness, and uncertainty experienced before surgery and anesthesia. A global systematic review reported that nearly half of surgical patients experience preoperative anxiety, while evidence from low- and middle-income countries showed an even higher pooled prevalence of 55.7% (Abate et al., 2020; Bedaso et al., 2022). A recent meta-analysis in Ethiopia also reported a pooled prevalence of 60%, and institutional evidence similarly identifies anxiety as an overlooked problem among surgical patients (Lami et al., 2025; Woldegerima Berhe et al., 2022). These findings show that preoperative anxiety is not merely an emotional reaction but a common perioperative condition that requires routine screening and appropriate management (Bello et al., 2025; Oteri et al., 2021).

Patients may experience preoperative anxiety because of fear of anesthesia, concern about surgical outcomes, fear of pain, fear of complications, loss of control, and uncertainty about recovery. Several studies have shown that female sex, younger age, lack of previous surgical experience, high information needs, and fear of complications are associated with higher preoperative anxiety (Bedaso & Ayalew, 2019; Bedaso et al., 2022; Eberhart et al., 2020). Patients who have never undergone surgery may have greater uncertainty because they do not yet have personal experience with anesthesia, operating room procedures, or postoperative recovery (Moerman et al., 1996; Oteri et al., 2021). Therefore, anxiety among preoperative patients should be understood as a multidimensional response influenced by individual characteristics, previous experience, surgical context, and information needs (Baagil et al., 2023; Wang et al., 2022).

Physiologically, anxiety activates the autonomic nervous system and neuroendocrine stress pathways that prepare the body for a fight-or-flight response. Sympathetic stimulation increases catecholamine release, cardiac contractility, heart rate, and peripheral vascular resistance, which may lead to elevated blood pressure and pulse rate (Baagil et al., 2023; Hall, 2021). Blood pressure regulation also involves complex cardiovascular and renal mechanisms, including vascular tone, cardiac output, the renin–angiotensin–aldosterone system, and natriuretic peptide activity (Tokudome & Otani, 2022; Triebel & Castrop, 2024). Therefore, excessive preoperative anxiety may contribute to hemodynamic changes that are clinically relevant before induction of anesthesia and surgical intervention (Bello et al., 2025; Tadesse et al., 2022).

Hemodynamic changes during the preoperative period are important because they may influence anesthetic planning, intraoperative stability, and patient safety. Tadesse et al. (2022) found that patients with high preoperative anxiety had increased mean arterial pressure, systolic blood pressure, and heart rate before arrival in the operating room and during anesthesia. Anxiety has also been linked with higher anesthetic and analgesic requirements, delayed recovery, postoperative adverse events, and less favorable surgical outcomes (Chen et al., 2022; Ni et al., 2023; Shebl et al., 2025). These findings indicate that preoperative anxiety may have measurable physiological consequences and should be considered part of perioperative risk assessment (Baagil et al., 2023; Bello et al., 2025).

Blood pressure and pulse rate are practical clinical indicators that can be measured easily before surgery and may reflect acute physiological stress. Increased blood pressure can indicate sympathetic activation and vascular resistance changes, while increased pulse rate may reflect

heightened cardiac response to psychological stress (Hall, 2021; Tadesse et al., 2022). In preoperative care, abnormal hemodynamic responses may create concerns for anesthesia induction, intraoperative bleeding risk, myocardial workload, and overall perioperative stability (Bello et al., 2025; Shebl et al., 2025). Therefore, examining the relationship between anxiety level and these vital signs is important for improving assessment, patient preparation, and early anxiety management.

Reliable measurement of preoperative anxiety is necessary so that psychological responses can be assessed systematically rather than based only on subjective clinical impressions. The Amsterdam Preoperative Anxiety and Information Scale (APAIS) is a brief and specific instrument developed to measure anxiety related to anesthesia, anxiety related to surgery, and the need for information (Moerman et al., 1996). The APAIS has been translated and validated in various languages, including Indonesian, and has shown acceptable validity and reliability for assessing preoperative anxiety (Jovanovic et al., 2022; Perdana et al., 2015). Its brevity makes APAIS useful in busy preoperative settings where health workers need a practical tool to identify anxious patients before surgery.

Recent evidence emphasizes the need to integrate psychological assessment into routine perioperative care. Systematic reviews and meta-analyses have shown that preoperative anxiety may influence anesthetic consumption, analgesic requirements, recovery time, postoperative delirium, and patient satisfaction (Chen et al., 2022; Shebl et al., 2025). Nonpharmacological approaches, including education, therapeutic communication, relaxation techniques, and other supportive strategies, have been recommended as safe and feasible methods to reduce preoperative anxiety (Bello et al., 2025; Wang et al., 2022). However, before effective interventions can be implemented, clinicians need local evidence showing how anxiety relates to physiological indicators such as blood pressure and pulse rate in the preoperative setting.

Although many studies have examined the prevalence and determinants of preoperative anxiety, evidence linking anxiety with both blood pressure and pulse rate remains context-dependent. Some studies focus mainly on anxiety prevalence or postoperative outcomes, while fewer studies assess immediate hemodynamic responses among patients waiting for surgery (Abate et al., 2020; Bedaso et al., 2022; Tadesse et al., 2022). In Indonesia, the availability of a validated Indonesian APAIS supports more standardized assessment of anxiety among surgical patients, but local evidence on its relationship with hemodynamic indicators remains needed (Perdana et al., 2015). Therefore, studying anxiety, blood pressure, and pulse rate together may help strengthen preoperative nursing and anesthesia assessment.

Understanding the association between preoperative anxiety and increased blood pressure and pulse rate has important implications for patient safety and perioperative care. If higher anxiety is associated with higher blood pressure and pulse rate, nurses and anesthesia providers can identify patients who require additional psychological support, education, or relaxation before surgery (Bello et al., 2025; Tadesse et al., 2022). Such evidence may also support routine anxiety screening as part of preoperative preparation and may help reduce preventable hemodynamic instability before anesthesia (Shebl et al., 2025; Wang et al., 2022). Therefore, this study aimed to analyze the association between preoperative anxiety level and increased blood pressure and pulse rate among surgical patients using a cross-sectional approach.

Methods

This study employed a quantitative observational approach with a cross-sectional design to examine the association between preoperative anxiety level and increased blood pressure and pulse rate among surgical patients. The study was conducted in the preoperative patient reception area of the Central Surgical Installation at PKU Muhammadiyah Yogyakarta Hospital, Yogyakarta, Indonesia.

Participants were selected using purposive sampling. Eligible participants were patients aged 17–59 years, scheduled for elective surgery under general anaesthesia, had never previously undergone surgery, were fully conscious, and were willing to provide written informed consent.

Patients were excluded if they underwent emergency surgery, experienced decreased consciousness, had a history of hypertension, had speech or hearing limitations, or had previously undergone surgery.

The final sample consisted of 55 preoperative patients, calculated from an accessible population of approximately 125 patients undergoing elective surgery under general anaesthesia per month using the Slovin formula with a 10% margin of error. Preoperative anxiety was measured using the Indonesian version of the Amsterdam Preoperative Anxiety and Information Scale (APAIS), consisting of six items scored on a five-point Likert scale. The total score ranged from 6 to 30 and was categorized as no anxiety (score 6), mild anxiety (scores 7–12), moderate anxiety (scores 13–18), severe anxiety (scores 19–24), or panic (scores 25–30). The Indonesian version of the APAIS had previously demonstrated acceptable validity, with validity coefficients greater than 0.70, and good internal consistency, with a Cronbach's alpha of 0.825.

Blood pressure and pulse rate were measured using a calibrated digital sphygmomanometer. Measurements were recorded in the surgical ward and subsequently repeated in the preoperative reception area of the Central Surgical Installation to identify preoperative changes in blood pressure and pulse rate. Blood pressure was classified as normal (100–119/80 mmHg), prehypertension (120–139/80–89 mmHg), or hypertension (≥140/90 mmHg), while pulse rate was classified as bradycardia (<60 beats/min), normal (60–100 beats/min), or tachycardia (>100 beats/min). Participant characteristics, including age, sex, previous surgical history, and type of surgery, were also recorded.

Data were analyzed using IBM SPSS Statistics version 24. Descriptive statistics, including frequencies and percentages, were used to summarize participant characteristics, preoperative anxiety level, blood pressure, and pulse rate. The association between preoperative anxiety level and blood pressure and the association between preoperative anxiety level and pulse rate were analyzed separately using the Spearman rank correlation test because the variables were measured on ordinal scales. Statistical significance was set at $p < 0.05$.

Ethical approval was obtained from the Research Ethics Committee of PKU Muhammadiyah Yogyakarta Hospital, No. 00109/KT.7.4/III/2026. All participants received information regarding the study objectives, procedures, voluntary participation, confidentiality, anonymity, and their right to withdraw from the study at any time. Written informed consent was obtained from all participants before data collection, and all participant information was kept confidential throughout the study.

Results

Table 1: Characteristics of participants

Variable	Category	n	%
Sex	Male	20	36.4
	Female	35	63.6
Age, years	17–31	23	41.8
	32–45	12	21.8
	46–59	20	36.4
Previous surgical experience	None	55	100.0
Type of surgery	Minor	17	30.9
	Major	38	69.1
Preoperative anxiety level	Mild	20	36.4
	Moderate	25	45.5
	Severe	10	18.2
Blood pressure category	Normal	18	32.7
	Prehypertension	37	67.3
Pulse-rate category	Normal	19	34.5
	Tachycardia	36	65.5

A total of 55 preoperative patients completed the study and were included in the analysis. Most participants were female (63.6%), aged 17–31 years (41.8%), and scheduled for major surgery (69.1%). All participants were undergoing surgery for the first time. Moderate preoperative anxiety was the most frequently identified category, reported by 25 participants (45.5%), followed by mild anxiety in 20 participants (36.4%) and severe anxiety in 10 participants (18.2%). Prehypertension was observed in 37 participants (67.3%), while 36 participants (65.5%) had tachycardia.

The proportion of participants with prehypertension increased with the severity of preoperative anxiety. Prehypertension was identified in 25.0% of participants with mild anxiety, 88.0% of those with moderate anxiety, and all participants with severe anxiety. A similar pattern was observed for pulse rate, with tachycardia occurring in 35.0% of participants with mild anxiety, 76.0% of those with moderate anxiety, and 100.0% of those with severe anxiety.

Table 2: Cross-tabulation of preoperative anxiety with blood pressure and pulse rate

Preoperative anxiety level	Normal blood pressure		Prehypertension		Normal pulse rate		Tachycardia	
	n	%	n	%	n	%	n	%
Mild	15	75.0	5	25.0	13	65.0	7	35.0
Moderate	3	12.0	22	88.0	6	24.0	19	76.0
Severe	0	0.0	10	100.0	0	0.0	10	100.0
Total	**18**	**32.7**	**37**	**67.3**	**19**	**34.5**	**36**	**65.5**

Note. Percentages for the mild, moderate, and severe anxiety categories were calculated within each anxiety category.

Spearman's rank correlation analysis demonstrated significant positive associations between preoperative anxiety level and both hemodynamic parameters. Preoperative anxiety level was positively associated with blood pressure category ($\rho = 0.654$, $p < 0.001$) and pulse-rate category ($\rho = 0.515$, $p < 0.001$). The magnitude of the correlation was greater for blood pressure than for pulse rate.

Table 3: Spearman's rank correlations between preoperative anxiety and hemodynamic parameters

Variables correlated	Spearman's ρ	*p*-value
Preoperative anxiety level and blood pressure category	0.654	<0.001
Preoperative anxiety level and pulse-rate category	0.515	<0.001

Note. Statistical significance was set at p < 0.05. All correlation tests were two-tailed.

Discussion

This study demonstrated significant positive associations between preoperative anxiety level and both blood pressure and pulse-rate categories among patients undergoing elective surgery under general anaesthesia. The association was stronger for blood pressure ($\rho = 0.654$) than for pulse rate ($\rho = 0.515$), indicating that anxiety severity was more closely related to the observed blood pressure category. A progressive pattern was evident, as prehypertension and tachycardia became increasingly common from mild to severe anxiety, and all participants with severe anxiety experienced both conditions. Nevertheless, because the study used a cross-sectional design, these findings indicate association rather than a causal effect of anxiety on hemodynamic changes.

Moderate anxiety was the most common category, and none of the participants were free from preoperative anxiety, confirming that psychological distress was prominent in this surgical population. This finding is consistent with systematic reviews reporting that preoperative anxiety affects a substantial proportion of surgical patients, although prevalence estimates vary according to population characteristics, surgical procedures, measurement instruments, and assessment timing (Abate et al., 2020; Bedaso et al., 2022). The predominance of women, first-time surgical patients, and participants undergoing major surgery may have contributed to the observed anxiety profile because unfamiliarity, perceived surgical risk, and fear of anaesthesia or postoperative outcomes are recognized sources of preoperative concern (Eberhart et al., 2020; Oteri et al., 2021). However, these characteristics should not be interpreted as independent

determinants because the present study did not perform subgroup comparisons or multivariable analyses.

The positive association between anxiety and blood pressure is physiologically plausible through activation of the sympathetic–adrenal response. Psychological threat stimulates catecholamine release, increases myocardial contractility and cardiac output, and produces peripheral vasoconstriction, collectively contributing to elevations in systolic and diastolic pressure. This mechanism may explain why prehypertension was present in only one-quarter of participants with mild anxiety but in almost all participants with moderate or severe anxiety. Similarly, Tadesse et al. (2022) found that high preoperative anxiety was associated with increased systolic blood pressure, mean arterial pressure, and heart rate on arrival in the operating room.

Preoperative anxiety was also positively associated with pulse-rate category, with tachycardia occurring more frequently as anxiety severity increased. Sympathetic activation accelerates sinoatrial node activity and produces a positive chronotropic response, thereby increasing pulse rate as part of the fight-or-flight reaction. The weaker correlation for pulse rate compared with blood pressure may reflect the greater short-term variability of heart rate and its sensitivity to respiration, physical movement, pain, medication, waiting time, and environmental stimulation. Nevertheless, the observed relationship is consistent with evidence that highly anxious surgical patients commonly demonstrate increases in both heart rate and blood pressure during the immediate preoperative period (Baagil et al., 2023; Bello et al., 2025).

These findings are clinically relevant because elevated blood pressure and tachycardia immediately before surgery may complicate pre-anaesthetic evaluation and indicate heightened physiological stress. Previous research has linked greater preoperative anxiety with altered hemodynamic responses, increased anaesthetic or analgesic requirements, greater postoperative pain, lower satisfaction, and less favourable recovery outcomes (Chen et al., 2022; Shebl et al., 2025). Routine anxiety screening using a brief instrument such as the APAIS may therefore complement standard assessment of blood pressure and pulse rate by identifying patients requiring further psychological preparation. However, anxiety scores and vital-sign categories should support rather than replace comprehensive clinical evaluation because abnormal hemodynamic findings may also arise from underlying medical or situational factors.

The results support the integration of psychological assessment into routine preoperative nursing and anaesthesia care. Patients with moderate or severe anxiety may benefit from clear procedural information, therapeutic communication, reassurance, family involvement, guided breathing, relaxation, music, or other evidence-based nonpharmacological strategies before transfer to the operating room (Wang et al., 2022). These interventions are practical because they can be incorporated into preoperative preparation without necessarily delaying the surgical schedule, while patients with persistent severe anxiety may require further assessment or pharmacological management. Reassessment of anxiety, blood pressure, and pulse rate after an intervention may help clinicians determine whether the patient has achieved greater psychological and physiological stability.

Several limitations should be considered when interpreting these findings. The cross-sectional design did not establish temporal direction or causality, while the single-centre sample of 55 first-time surgical patients without a history of hypertension limits generalisability to broader perioperative populations. Potential confounders—including pain, caffeine intake, preoperative waiting time, medication use, type and duration of surgery, sleep quality, and family support—were not controlled, and categorising anxiety and physiological measurements may have reduced information compared with analysing continuous scores. Future multicentre prospective studies should use repeated standardized measurements, continuous APAIS and hemodynamic data, larger probability-based samples, and multivariable models to determine whether anxiety independently predicts preoperative blood pressure and pulse-rate changes.

Implication and limitation

The findings support the integration of routine preoperative anxiety screening, using instruments such as the APAIS, alongside blood pressure and pulse-rate assessment to identify patients who may benefit from additional psychological preparation, therapeutic communication, relaxation techniques, or further anaesthetic evaluation before surgery. However, the cross-sectional design prevents causal interpretation, while the single-centre setting, small purposively selected sample of 55 first-time surgical patients, and exclusion of patients with hypertension limit the generalizability of the results. Several potential confounders, including pain, medication use, caffeine intake, waiting time, sleep quality, family support, and type of surgery, were not controlled. In addition, categorizing anxiety and hemodynamic measurements may have reduced analytical precision, and the use of the total six-item APAIS score may not have clearly separated anxiety from information needs. Future multicentre prospective studies should use larger probability-based samples, repeated standardized measurements, separate APAIS subscale scoring, and multivariable analysis to clarify the independent relationship between preoperative anxiety and hemodynamic changes.

Relevance for Practice

Preoperative anxiety assessment should be incorporated into routine perioperative nursing and anaesthesia care because higher anxiety levels were associated with higher blood pressure and pulse-rate categories in this study. The APAIS can be used together with vital-sign monitoring to identify patients who may require additional explanation, therapeutic communication, reassurance, relaxation techniques, or further anaesthetic evaluation before surgery. Early recognition and management of anxiety may help improve patient comfort, support physiological stability, and facilitate safer preparation for anaesthesia and surgery. These findings also highlight the important role of nurses and nurse anaesthetists in providing individualized psychological support as part of comprehensive preoperative care.

Conclusion

Preoperative anxiety was significantly and positively associated with both blood pressure and pulse-rate categories among patients undergoing elective surgery under general anaesthesia. Higher anxiety levels were accompanied by a greater proportion of prehypertension and tachycardia, with a stronger association observed for blood pressure than for pulse rate. These findings indicate that psychological assessment should be considered alongside routine hemodynamic monitoring during preoperative preparation. Because this study used a cross-sectional design, the results should be interpreted as associations rather than evidence of a causal relationship.

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Author Contribution

Annisha Dwi Pricillia Tabara contributed to the conceptualization, methodology, investigation, data collection, data curation, formal analysis, and preparation of the original manuscript draft. Joko Murdiyanto contributed to the conceptualization, methodology, supervision, validation, interpretation of the findings, and critical review of the manuscript. Muhaji contributed to the methodology, supervision, validation, interpretation of the findings, and critical revision of the manuscript. All authors reviewed and approved the final version of the manuscript and agreed to be accountable for all aspects of the work.

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Declaration of Conflicting Interest

The authors declare no conflict of interest.

Declaration of Use of AI in Scientific Writing

The authors declare that generative AI and AI-assisted technologies were used to support language editing and grammatical refinement of the manuscript.

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