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Original article

Preoperative Anxiety and Its Impact on Hemodynamic Stability and Pain Score in Elective Surgeries

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ABSTRACT

Background: Preoperative anxiety is common among patients undergoing elective surgery and may influence perioperative physiological responses and postoperative pain; however, these relationships vary across surgical populations. Objective: To evaluate preoperative anxiety and its association with perioperative hemodynamic parameters and postoperative pain among adults undergoing elective surgery. Methods: This cross-sectional study included 60 adult patients undergoing elective surgery at Social Security Hospital and Sir Ganga Ram Hospital, Lahore, during early 2025. Preoperative anxiety was assessed using the Amsterdam Preoperative Anxiety and Information Scale (APAIS), postoperative pain using the Numeric Rating Scale (NRS), and hemodynamic status using heart rate and blood pressure measurements. Associations were examined using Pearson correlation and multivariable linear regression in SPSS version 26.0. Results: Mean age was 31.37 ± 8.04 years and 71.7% were female. Mean APAIS anxiety and NRS pain scores were 21.35 ± 1.58 and 5.02 ± 0.81, respectively. APAIS anxiety was not associated with postoperative pain ($r = -0.031$, $p = 0.814$). NRS scores correlated with heart rate at 1 minute ($r = -0.286$, $p = 0.027$), systolic blood pressure at 1 minute ($r = 0.401$, $p = 0.001$) and 5 minutes ($r = 0.340$, $p = 0.008$), and diastolic blood pressure at 1 minute ($r = 0.308$, $p = 0.017$). In multivariable analysis, heart rate at 1 minute ($B = -0.284$, $p = 0.003$) and 5 minutes ($B = 0.154$, $p = 0.037$) remained associated with pain, whereas APAIS anxiety did not. Conclusion: Preoperative anxiety was not significantly associated with postoperative pain, whereas selected early hemodynamic parameters showed modest associations with pain intensity. Combined psychological, physiological, and direct pain assessment may provide a more comprehensive approach to perioperative evaluation. Keywords: Preoperative anxiety; APAIS; postoperative pain; hemodynamic stability; heart rate; blood pressure; elective surgery.

EDITORIAL INFORMATION

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INTRODUCTION

Preoperative anxiety is a common psychological response among patients awaiting elective surgery and may arise from concerns regarding anesthesia, the surgical procedure, postoperative pain, complications, loss of control, and uncertainty regarding recovery. Its reported prevalence varies considerably across surgical populations and healthcare settings, reflecting differences in patient characteristics, type of surgery, anesthetic technique, perioperative preparation, and the instruments used for assessment (1–3). Beyond psychological distress, preoperative anxiety may activate sympathetic and neuroendocrine responses that influence heart rate and arterial blood pressure, potentially contributing to greater perioperative hemodynamic variability (3,4).

Maintenance of hemodynamic stability is an important component of safe perioperative care. Anxiety-related sympathetic activation can increase circulating catecholamine and produce changes in heart rate, vascular tone, and blood pressure, particularly during the period surrounding anesthetic induction and surgical stimulation (4,5). Previous studies have demonstrated associations between greater preoperative anxiety and perioperative cardiovascular responses, although the magnitude and clinical

significance of these relationships vary according to surgical population and anesthetic technique (5–7). These observations suggest that psychological status may contribute to physiological responses during surgery and support assessment of anxiety alongside conventional perioperative monitoring.

Preoperative psychological status may also influence postoperative pain. Anxiety can alter pain perception through heightened vigilance, anticipatory fear, autonomic activation, and cognitive-emotional modulation of nociceptive processing. Previous studies have reported that patients with greater preoperative anxiety may experience higher postoperative pain intensity, increased analgesic requirements, or less favorable recovery (8–10). However, this relationship has not been consistent across all surgical populations, and postoperative pain is influenced by multiple interacting factors, including the surgical procedure, anesthetic technique, analgesic management, previous surgical experience, and individual variability in pain perception (9–11). Consequently, the independent contribution of preoperative anxiety to postoperative pain remains clinically relevant but requires evaluation within specific perioperative settings.

Reliable assessment of preoperative anxiety is therefore important when examining its relationship with physiological and postoperative outcomes. The Amsterdam Preoperative Anxiety and Information Scale (APAIS) is a brief patient-reported instrument developed to assess anxiety related to anesthesia and surgery together with the patient's need for perioperative information (12). Its concise structure facilitates use during routine preoperative assessment and has supported its application across different surgical populations. When combined with objective physiological measurements such as heart rate and blood pressure and a standardized postoperative pain measure such as the Numeric Rating Scale, the APAIS provides a practical framework for evaluating relationships between psychological distress, perioperative physiological responses, and pain outcomes.

Although preoperative anxiety and its perioperative consequences have been widely investigated internationally, the relationship between anxiety, hemodynamic responses, and postoperative pain may differ across patient populations and clinical environments. Evidence from local and regional surgical settings remains comparatively limited, while institutional differences in patient preparation, communication, anesthetic practice, and perioperative care may influence these relationships. Examining psychological and physiological measures within the same surgical cohort may therefore provide clinically relevant evidence for identifying factors associated with perioperative instability and postoperative pain.

Accordingly, this study aimed to evaluate preoperative anxiety and examine its association with perioperative hemodynamic parameters and postoperative pain among adult patients undergoing elective surgery at Social Security Hospital and Sir Ganga Ram Hospital, Lahore. Preoperative anxiety was assessed using the APAIS, hemodynamic status was evaluated through heart rate and blood pressure measurements, and postoperative pain was assessed using the Numeric Rating Scale. The study further examined whether preoperative anxiety and measured hemodynamic variables were independently associated with postoperative pain.

MATERIALS AND METHODS

This cross-sectional study was conducted at Social Security Hospital and Sir Ganga Ram Hospital, Lahore, Pakistan, over a four-month period from July 2024 to October 2024. The study included 60 adult patients scheduled for elective surgical procedures. Participants were recruited using purposive sampling. Patients aged ≥18 years, classified as American Society of Anesthesiologists (ASA) physical status I or II, and undergoing elective surgery under general or regional anesthesia were eligible. Patients undergoing emergency surgery, those with known psychiatric illness or cognitive impairment affecting anxiety or pain assessment, severe cardiovascular instability or critical illness likely to independently influence hemodynamic parameters, inability to complete the questionnaire, refusal to participate, or incomplete study data were excluded.

The sample size was determined using the standard single-population proportion formula for cross-sectional studies, with a final required sample of 60 participants. After institutional permission and ethical approval, eligible patients were approached before surgery and written informed consent was obtained. Demographic and clinical characteristics, including age, sex, marital status, ASA physical

status, anesthetic technique, previous surgical history, and surgical complications, were recorded using a structured data-collection form.

Preoperative anxiety was assessed using the Amsterdam Preoperative Anxiety and Information Scale (APAIS), a six-item instrument assessing anxiety related to anesthesia and surgery together with the patient's need for information (12). The relevant item and domain scores were recorded according to the study questionnaire. Postoperative pain intensity was assessed using the Numeric Rating Scale (NRS), on which greater scores represent greater pain intensity. Hemodynamic assessment included heart rate and systolic and diastolic blood pressure recorded at the predefined perioperative measurement points reported in the study protocol. These measures were evaluated alongside APAIS and NRS scores to examine relationships between preoperative anxiety, hemodynamic responses, and postoperative pain.

Data were analysed using IBM SPSS Statistics version 26.0. Categorical variables were summarized as frequencies and percentages, whereas continuous variables were presented as mean ± standard deviation with minimum and maximum values. Pearson correlation analysis was used to assess associations between anxiety scores, hemodynamic variables, and postoperative pain. Multivariable linear regression was performed to evaluate the independent association of preoperative anxiety and selected hemodynamic variables with NRS pain score. Model fit was expressed using R^2, adjusted R^2, and the overall F statistic. A two-sided p value <0.05 was considered statistically significant.

The study was conducted in accordance with the ethical requirements of Institutional Review Board of the University of Lahore (Ref. No.: DRC/DHPT024/06/24) and permission was obtained from the participating hospitals before data collection. Participation was voluntary, written informed consent was obtained from all participants, and confidentiality of participant information was maintained throughout data collection and analysis.

The study received ethical approval from the Institutional Review Board of the University of Lahore (Ref. No.: DRC/DHPT011/05/25) and was conducted in accordance with the Declaration of Helsinki.

RESULTS

A total of 60 patients undergoing elective surgery were included in the analysis. The mean age was 31.37 ± 8.04 years (range, 21–49 years), with most participants aged 31–40 years (43.3%). Females constituted 71.7% (n = 43) of the sample. ASA physical status I and II accounted for 53.3% and 46.7% of participants, respectively. General anesthesia was administered to 29 (48.3%) patients and regional anesthesia to 31 (51.7%). Previous surgery was reported by 31 (51.7%) participants (Table 1).

Table 1. Demographic and Clinical Characteristics of Participants

Characteristic	Category	n (%)
Age group, years	18–30	22 (36.7)
	31–40	26 (43.3)
	41–50	12 (20.0)
Sex	Male	17 (28.3)
	Female	43 (71.7)
ASA physical status	I	32 (53.3)
	II	28 (46.7)
Marital status	Married	55 (91.7)
	Single	5 (8.3)
Type of anaesthesia	General	29 (48.3)
	Regional	31 (51.7)
Previous surgery	No	29 (48.3)
	Yes	31 (51.7)
Surgical complications	No	30 (50.0)
	Yes	30 (50.0)
Age, years	Mean ± SD	31.37 ± 8.04
	Range	21–49

ASA, American Society of Anesthesiologists; SD, standard deviation.

Preoperative anxiety scores showed relatively limited variability within the study population. The mean APAIS anxiety score was 21.35 ± 1.58, comprising anesthesia- and surgery-related anxiety scores of 10.63 ± 1.12 and 10.72 ± 0.74, respectively. The mean total APAIS score was 31.92 ± 1.33. Mean postoperative NRS pain score was 5.02 ± 0.81. Hemodynamic measurements showed modest changes in heart rate between the preoperative, 1-minute, and 5-minute measurements, whereas mean systolic and diastolic blood pressures were higher at 5 minutes than at 1 minute (Table 2).

Table 2. Preoperative Anxiety, Postoperative Pain, and Hemodynamic Characteristics

Variable	Mean ± SD	Minimum	Maximum
APAIS anaesthesia anxiety score	10.63 ± 1.12	8	12
APAIS surgery anxiety score	10.72 ± 0.74	9	12
APAIS anxiety score	21.35 ± 1.58	19	24
APAIS information score	10.57 ± 0.91	9	12
Total APAIS score	31.92 ± 1.33	29	34
NRS pain score	5.02 ± 0.81	4	6
Preoperative heart rate, beats/min	81.13 ± 3.31	77	92
Heart rate at 1 min, beats/min	80.23 ± 1.48	78	84
Heart rate at 5 min, beats/min	81.02 ± 1.85	79	85
Systolic BP at 1 min, mmHg	158.25 ± 16.62	125	181
Systolic BP at 5 min, mmHg	163.62 ± 17.88	138	191
Diastolic BP at 1 min, mmHg	92.48 ± 11.82	78	110
Diastolic BP at 5 min, mmHg	97.33 ± 19.70	78	135

APAIS, Amsterdam Preoperative Anxiety and Information Scale; BP, blood pressure; NRS, Numeric Rating Scale; SD, standard deviation.

Postoperative NRS scores ranged from 4 to 6, placing all participants within the moderate-pain category. An NRS score of 5 was most frequent, occurring in 21 (35.0%) participants, followed by a score of 6 in 20 (33.3%) and a score of 4 in 19 (31.7%). The distribution was therefore concentrated within a narrow range around the overall mean of 5.02 (Table 3).

Table 3. Distribution of Postoperative Pain Scores)

NRS score	Pain category	n (%)
4	Moderate	19 (31.7)
5	Moderate	21 (35.0)
6	Moderate	20 (33.3)
Total		60 (100.0)

NRS, Numeric Rating Scale.

Correlation analysis did not demonstrate a significant association between preoperative anxiety and postoperative pain. The overall APAIS anxiety score showed essentially no correlation with NRS pain score ($r = -0.031$, $p = 0.814$), and neither anesthesia-related anxiety, surgery-related anxiety, information-seeking score, nor total APAIS score was significantly associated with pain. In contrast, selected hemodynamic variables were associated with postoperative NRS score. Heart rate at 1 minute showed a weak inverse correlation ($r = -0.286$, $p = 0.027$), whereas systolic BP at 1 minute demonstrated the strongest positive correlation ($r = 0.401$, $p = 0.001$). Systolic BP at 5 minutes ($r = 0.340$, $p = 0.008$) and diastolic BP at 1 minute ($r = 0.308$, $p = 0.017$) were also positively correlated with pain (Table 4).

Table 4. Correlations of Preoperative Anxiety and Hemodynamic Variables with Postoperative Pain

Variable	Pearson r	p value
APAIS anesthesia anxiety score	0.044	0.738
APAIS surgery anxiety score	−0.133	0.310
APAIS anxiety score	−0.031	0.814
APAIS information score	−0.105	0.426
Total APAIS score	−0.108	0.410
Age	0.007	0.959
Preoperative heart rate	0.094	0.476

Variable	Pearson r	p value
Heart rate at 1 min	−0.286	0.027
Heart rate at 5 min	0.011	0.933
Systolic BP at 1 min	0.401	0.001
Systolic BP at 5 min	0.340	0.008
Diastolic BP at 1 min	0.308	0.017
Diastolic BP at 5 min	0.219	0.093

Outcome variable: postoperative NRS pain score. APAIS, Amsterdam Preoperative Anxiety and Information Scale; BP, blood pressure. Two-sided p < 0.05 was considered statistically significant.

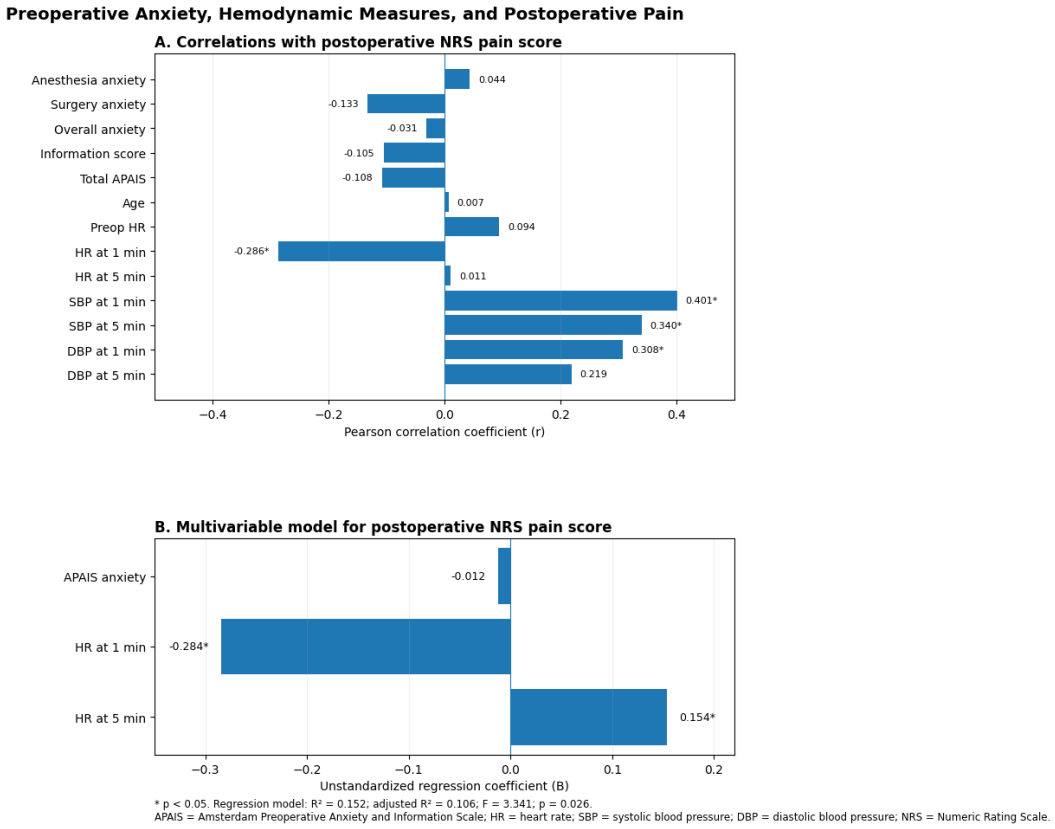
In the multivariable linear regression model, APAIS anxiety score was not independently associated with postoperative pain (B = −0.012, *p* = 0.853). Heart rate at 1 minute was inversely associated with NRS score (B = −0.284, *p* = 0.003), whereas heart rate at 5 minutes showed a positive association (B = 0.154, *p* = 0.037). The overall model was statistically significant (*F* = 3.341, *p* = 0.026), explaining 15.2% of the observed variance in postoperative pain (R^2 = 0.152; adjusted R^2 = 0.106) (Table 5).

Table 5. Multiple Linear Regression Analysis of Factors Associated with Postoperative Pain Score

Predictor	B coefficient	p value
APAIS anxiety score	−0.012	0.853
Heart rate at 1 min	−0.284	0.003
Heart rate at 5 min	0.154	0.037
Model statistic	**Value**	
R^2	0.152	
Adjusted R^2	0.106	
F statistic	3.341	
Overall p value	0.026	

Dependent variable: postoperative NRS pain score. B, unstandardized regression coefficient; APAIS, Amsterdam Preoperative Anxiety and Information Scale. Two-sided p < 0.05 was considered statistically significant.

Figure 1. Associations of preoperative anxiety and perioperative hemodynamic measures with postoperative pain.



Panel A presents Pearson correlations with postoperative NRS pain score. Anxiety measures were not significantly correlated with pain, including overall APAIS anxiety ($r = -0.031$, $p = 0.814$). In contrast, significant associations were observed for heart rate at 1 minute ($r = -0.286$, $p = 0.027$), systolic BP at 1 minute ($r = 0.401$, $p = 0.001$), systolic BP at 5 minutes ($r = 0.340$, $p = 0.008$), and diastolic BP at 1 minute ($r = 0.308$, $p = 0.017$). Panel B shows the multivariable model, in which heart rate at 1 minute (B = −0.284, $p = 0.003$) and 5 minutes (B = 0.154, $p = 0.037$) remained associated with NRS score, whereas APAIS anxiety did not (B = −0.012, $p = 0.853$). The model explained 15.2% of pain-score variance ($R^2 = 0.152$; adjusted $R^2 = 0.106$; $F = 3.341$, $p = 0.026$).

DISCUSSION

This study examined the relationship between preoperative anxiety, perioperative hemodynamic parameters, and postoperative pain among patients undergoing elective surgery. The principal finding was that preoperative anxiety was not significantly associated with postoperative pain despite relatively high anxiety scores in the study population. In contrast, selected hemodynamic parameters, particularly early heart rate and blood pressure measurements, were significantly associated with pain intensity. In multivariable analysis, heart rate at 1 and 5 minutes remained independently associated with postoperative NRS scores, whereas the APAIS anxiety score did not. These findings suggest that the relationship between psychological distress and postoperative pain may be more complex than a direct anxiety–pain association.

Preoperative anxiety is common among surgical patients and is influenced by fear of anesthesia, anticipated pain, uncertainty regarding surgical outcomes, previous experiences, and individual psychosocial characteristics (1–4). Earlier studies have identified younger age, female sex, limited information, fear of anesthesia, and previous surgical experiences among factors associated with increased anxiety (2,4–6). Anxiety is clinically relevant because psychological stress may activate sympathetic and neuroendocrine pathways, producing changes in heart rate, vascular resistance, and arterial blood pressure during the perioperative period (7–10). These physiological effects provide a rationale for assessing psychological status alongside routine hemodynamic monitoring in patients undergoing elective surgery.

The absence of a significant association between APAIS anxiety and postoperative pain in the present study differs from several previous investigations. Fernández-Castro et al. reported an association between preoperative anxiety and postoperative pain among cardiac surgical patients, while studies in orthopedic and other surgical populations have similarly suggested that greater preoperative psychological distress may be associated with increased postoperative pain or analgesic requirements (11–14). Systematic reviews have also identified anxiety and pain catastrophizing as potential predictors of acute or persistent postsurgical pain (15,16). Earlier work by Caumo et al. demonstrated that psychological factors contribute to the risk of moderate-to-severe postoperative pain, while Mavros et al. emphasized the broader influence of psychological variables on surgical recovery (17,18). Nevertheless, the magnitude and consistency of these associations vary considerably between populations.

Several factors may explain the present null association. Postoperative pain is a multidimensional experience influenced by the nature and extent of surgery, anesthetic technique, analgesic treatment, previous pain experience, psychological characteristics, and individual nociceptive sensitivity (15,17,19). In the present sample, postoperative NRS scores were restricted to 4–6, with a mean of 5.02 ± 0.81, indicating relatively limited between-patient variability. Such a narrow outcome distribution may reduce the ability to demonstrate relationships with psychological variables. Previous large surgical cohorts have shown considerably greater heterogeneity in postoperative pain intensity (19,20). Differences in surgical case mix and the inclusion of both general and regional anesthesia may have further contributed to variation in the relationship between anxiety and pain.

The hemodynamic findings were more prominent. Systolic blood pressure at 1 minute showed the strongest positive association with postoperative pain (r = 0.401, p = 0.001), while systolic pressure at 5 minutes and diastolic pressure at 1 minute were also significantly associated with NRS scores. Anxiety, surgical stimulation, and pain can activate sympathetic pathways and catecholamine release, producing changes in vascular tone, arterial pressure, and heart rate (7–10,21). Previous studies have

reported relationships between preoperative psychological stress and perioperative hemodynamic fluctuations, while interventions that reduce anxiety have sometimes been accompanied by more stable cardiovascular responses (8,9,22,23). However, heart rate and blood pressure are influenced by numerous perioperative factors and cannot be regarded as specific measures of pain.

Heart rate demonstrated a more complex pattern. Heart rate at 1 minute was negatively correlated with postoperative pain ($r = -0.286$, $p = 0.027$), and in the multivariable model heart rate at 1 minute remained negatively associated with NRS score ($B = -0.284$, $p = 0.003$), whereas heart rate at 5 minutes showed a positive association ($B = 0.154$, $p = 0.037$). Variability in autonomic responses may arise from anesthetic agents, analgesics, intravascular volume, surgical stimulation, baseline cardiovascular characteristics, and the timing of physiological measurements (7,21,24). Consequently, these findings should be interpreted as associations rather than evidence that heart rate independently measures or predicts pain in routine practice.

The overall regression model was statistically significant but explained only 15.2% of the variance in postoperative NRS scores (adjusted $R^2 = 0.106$). This modest explanatory capacity reinforces the multifactorial nature of postoperative pain. Previous literature has identified preoperative pain, anxiety, catastrophizing, type of surgery, younger age, and analgesic requirements among potential contributors to postoperative pain outcomes (15–18,25). Psychological preparation, adequate communication, and preoperative education may nevertheless remain clinically valuable even when anxiety does not independently predict pain, because these interventions may improve patient understanding, satisfaction, and the overall perioperative experience (26–29).

The findings also have practical implications for perioperative assessment. APAIS provides a brief approach to evaluating anxiety related to anesthesia and surgery and the patient's need for information (30). Routine psychological screening can therefore identify patients requiring additional explanation or support, but it should not replace comprehensive clinical assessment. Similarly, hemodynamic changes should be interpreted together with direct patient-reported pain scores and the broader clinical context. Evidence from perioperative research supports multimodal assessment because physiological responses alone have limited specificity for subjective pain intensity (15,20,31).

This study has strengths in evaluating psychological, physiological, and pain-related measures within the same cohort and recruiting participants from two hospitals. However, the relatively small sample size limits statistical precision and generalizability. The observational design precludes causal inference, while the narrow distribution of NRS scores may have reduced the ability to identify weaker associations. Inclusion of both general and regional anesthesia introduced clinical heterogeneity, and other potentially important determinants of postoperative pain were not represented in the reported regression model. These considerations are consistent with the broader literature showing substantial variability in psychological and postoperative recovery trajectories across surgical populations (18,25,32).

Overall, the present findings indicate that preoperative anxiety was not independently associated with postoperative pain in this cohort, whereas selected early hemodynamic measurements showed statistically significant but modest associations. These results do not diminish the clinical relevance of preoperative anxiety; rather, they demonstrate that postoperative pain cannot be adequately explained by a single psychological or physiological measure. Combining psychological assessment, routine physiological monitoring, and direct pain evaluation remains a more appropriate approach to perioperative patient assessment.

CONCLUSION

Preoperative anxiety was common among patients undergoing elective surgery; however, it was not significantly associated with postoperative pain in this study. In contrast, selected perioperative hemodynamic parameters, particularly early heart rate and blood pressure measurements, showed significant associations with pain intensity, although the regression model explained only a modest proportion of its variability. These findings indicate that postoperative pain is multifactorial and that preoperative anxiety alone may have limited value in identifying patients likely to experience greater pain in this population. Integrating psychological assessment with routine hemodynamic monitoring and

direct patient-reported pain assessment may provide a more comprehensive approach to perioperative evaluation and postoperative care.

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