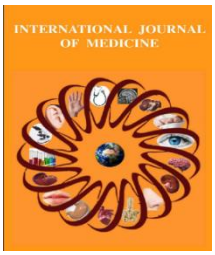

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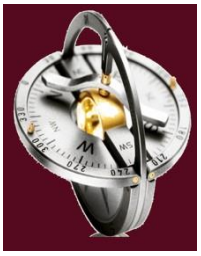

**Original Research**

# Association Between Preoperative Anxiety and Postoperative Pain Severity in Patients Undergoing Elective Surgery: An Observational Study.

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Abstract

*Background:* Preoperative anxiety is frequent among surgical patients and can amplify postoperative pain through heightened autonomic arousal, altered pain appraisal, and increased nociceptive sensitivity. *Objectives:* To determine the prevalence of clinically relevant preoperative anxiety and assess its association with postoperative pain severity and analgesic requirements among adults undergoing elective surgery. *Methods:* This prospective observational study included 60 adults undergoing elective surgery at Vijayanagara Institute of Medical Sciences, Ballari, Karnataka, India, from October 2022 to June 2023. Preoperative anxiety was measured using the Amsterdam Preoperative Anxiety and Information Scale. An anxiety subscore of ≥11 indicated high anxiety. Postoperative pain was assessed using the 11-point Numerical Rating Scale at 2, 6, 12, and 24 hours. Rescue analgesia, time to first rescue dose, and 24-hour opioid consumption were recorded. Correlation and multivariable linear regression analyses were performed. *Results:* The mean age was 46.8 ± 13.5 years, and 32 (53.3%) participants were male. High preoperative anxiety was identified in 26 (43.3%) patients. Mean pain scores were significantly higher in the high-anxiety group at 2 hours (6.2 ± 1.4 versus 4.2 ± 1.5), 6 hours (5.4 ± 1.3 versus 3.6 ± 1.4), 12 hours (4.3 ± 1.4 versus 2.9 ± 1.3), and 24 hours (3.1 ± 1.3 versus 2.1 ± 1.1). Rescue analgesia was required by 80.8% of highly anxious patients compared with 41.2% of others. Anxiety scores correlated positively with pain at all assessment points. Preoperative anxiety independently predicted the 6-hour pain score after adjustment for age, sex, anaesthetic technique, and surgical category. *Conclusion:* Elevated preoperative anxiety was common and independently associated with greater postoperative pain, earlier rescue analgesia, and higher opioid consumption. Routine anxiety screening can support individualized perioperative pain management.

Keywords: *Analgesic consumption; Amsterdam Preoperative Anxiety and Information Scale; elective surgery; Numerical Rating Scale; postoperative pain; preoperative anxiety.*

## Introduction

Elective surgery is accompanied by psychological stress arising from uncertainty about anaesthesia, operative outcomes, postoperative pain, loss of control, and possible complications. Preoperative anxiety represents a transient emotional state characterized by apprehension, tension, and heightened autonomic activity before an operation. Although its intensity varies across populations and procedures, clinically important anxiety is frequently reported among adults awaiting elective surgery. Large observational studies have shown that concerns related to anaesthesia, surgical error, postoperative recovery, and unfavourable outcomes remain prominent, while female sex and previous negative healthcare experiences often increase vulnerability.[1,2]

Postoperative pain continues to be an important clinical problem despite advances in anaesthetic techniques and multimodal analgesia. Moderate or severe pain is experienced by a substantial proportion of surgical inpatients during the early postoperative period, and high pain scores have also been documented after procedures commonly considered minor.[3,4] Poorly controlled acute pain delays mobilization, impairs pulmonary function, interrupts sleep, increases sympathetic activation, reduces patient satisfaction, and can contribute to persistent postsurgical pain. Because patients undergoing similar operations often report markedly different pain intensities, attention has shifted from procedural factors alone toward individual psychological and behavioural predictors.

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Anxiety can influence postoperative pain through several interacting pathways. Anticipatory fear increases vigilance toward threatening sensations, promotes catastrophic interpretation of nociceptive stimuli, and lowers perceived coping ability. Sympathetic and neuroendocrine activation can further intensify the stress response. Prospective investigations have demonstrated direct and indirect relationships between preoperative anxiety and postoperative pain, while anxiety and pain catastrophizing have correlated with pain intensity after abdominal surgery.[5,6] A qualitative systematic review identified preoperative anxiety, pre-existing pain, age, and type of surgery as important predictors of postoperative pain, and a later meta-analysis confirmed anxiety symptoms as a significant predictor of inadequate acute pain control.[7,8] Reliable identification of anxiety is therefore relevant to perioperative risk assessment. The Amsterdam Preoperative Anxiety and Information Scale is a brief six-item instrument developed for surgical patients and can be completed rapidly during routine assessment.[9] It distinguishes anxiety related to anaesthesia and surgery from the patient's need for information and has demonstrated acceptable reliability and clinical utility. Reviews of available measurement instruments also support its practicality in perioperative research.[10] Screening before surgery creates an opportunity for targeted counselling, clarification of misconceptions, psychological support, and anticipatory analgesic planning.

The present study was undertaken to evaluate the relationship between preoperative anxiety and early postoperative pain in adults undergoing elective surgery at a tertiary care hospital. The primary objective was to determine the association between the preoperative anxiety score and postoperative pain severity at 2, 6, 12, and 24 hours. The secondary objectives were to estimate the prevalence of clinically relevant anxiety, compare rescue analgesic requirements and opioid consumption between anxiety groups, examine demographic and perioperative correlates of anxiety, and determine whether anxiety independently predicted the 6-hour postoperative pain score after adjustment for relevant covariates.

## Materials and Methods

**Study design and setting:** This prospective observational study was conducted in the Departments of Anaesthesiology and Surgery at Vijayanagara Institute of Medical Sciences (VIMS), Ballari, Karnataka, India, from October 2022 to June 2023. Necessary Permissions were obtained before starting the study. Written informed consent was obtained from every participant, and the study followed the Declaration of Helsinki.

**Study population:** Adults aged 18-75 years, classified as American Society of Anesthesiologists physical status I-III, and scheduled for elective surgery under general or regional anaesthesia were screened consecutively. Exclusion criteria were emergency surgery, diagnosed psychiatric illness, cognitive impairment, inability to understand the questionnaires, chronic pain requiring regular analgesics or opioids, administration of sedatives before anxiety assessment, and incomplete postoperative observations.

**Sample size:** Assuming a moderate correlation of 0.36 between preoperative anxiety and postoperative pain, a two-sided alpha of 0.05, and 80% power, the minimum sample was estimated as 59. A final sample of 60 patients was planned, and 64 patients were screened to account for exclusion or refusal.

**Data collection and anxiety assessment:** Recorded variables included age, sex, body mass index, previous surgical experience, ASA physical status, anaesthetic technique, surgical category, and duration of surgery. Anxiety was assessed during preanaesthetic evaluation, before sedative premedication, using the Amsterdam Preoperative Anxiety and Information Scale.[9,10] The six statements are rated from 1 to 5. Four items form an anxiety subscore ranging from 4 to 20, and two items assess information requirements. A subscore of ≥11 indicated high anxiety; lower scores represented low-to-moderate anxiety.

**Postoperative pain and analgesia:** Pain was measured with an 11-point Numerical Rating Scale, where 0 represented no pain and 10 the worst imaginable pain. Assessments were completed at 2, 6, 12, and 24 hours after surgery. Moderate-to-severe pain was defined as a score of ≥4. Patients received multimodal analgesia according to institutional practice. Rescue analgesia was provided for a pain score of ≥4 or on patient request. Rescue medication use, time to the first dose, and 24-hour opioid consumption were recorded. Opioid doses were converted to intravenous morphine equivalents.

**Statistical analysis:** Data were analysed using IBM SPSS Statistics version 25.0. Continuous variables were expressed as mean ± standard deviation and categorical variables as frequency and percentage. Normality was tested with the Shapiro-Wilk test. Independent-samples t-tests and chi-square tests were used for between-group comparisons. Repeated-measures analysis of variance assessed changes in pain over time. Pearson correlation evaluated associations between anxiety and pain scores. Multivariable linear regression was performed with the 6-hour pain score as the dependent variable. Anxiety score, age, sex, anaesthetic technique, and surgical category were entered as predictors. Regression coefficients with 95% confidence intervals were reported. A two-sided p-value <0.05 was statistically significant.

## Results

### Participant recruitment

During the study period, 64 patients scheduled for elective surgery were assessed for eligibility. Four patients were excluded: two did not fulfil the eligibility criteria and two declined to participate. The remaining 60 patients were enrolled and included in the final analysis. Complete preoperative anxiety assessments and postoperative pain measurements were available for all participants.

### Demographic and perioperative characteristics

The mean age of the participants was 46.8 ± 13.5 years, with an age range of 19-72 years. Thirty-two (53.3%) patients were male and 28 (46.7%) were female. The mean body mass index was 25.4 ± 3.9 kg/m². Twenty-seven (45.0%) participants had undergone previous surgery.

According to the American Society of Anesthesiologists physical status classification, 29 (48.3%) patients belonged to grade I, 25 (41.7%) to grade II, and 6 (10.0%) to grade III. General anaesthesia was administered to 36 (60.0%) patients, whereas 24 (40.0%) received regional anaesthesia. Twenty-six (43.3%) underwent major surgery, and 34 (56.7%) underwent minor or intermediate surgery. The mean duration of surgery was 106.9 ± 36.4 minutes. The baseline characteristics are summarized in Table 1.

**Table 1. Demographic and perioperative characteristics of the participants**

| Characteristic | Value |
|---|---|
| Total participants | 60 |
| Age, years, mean ± SD | 46.8 ± 13.5 |
| Age range, years | 19-72 |
| Male sex | 32 (53.3) |
| Female sex | 28 (46.7) |
| Body mass index, kg/m², mean ± SD | 25.4 ± 3.9 |
| Previous surgical experience | 27 (45.0) |
| ASA physical status I | 29 (48.3) |
| ASA physical status II | 25 (41.7) |
| ASA physical status III | 6 (10.0) |
| General anaesthesia | 36 (60.0) |
| Regional anaesthesia | 24 (40.0) |
| Major surgery | 26 (43.3) |
| Minor/intermediate surgery | 34 (56.7) |

| | |
|---|---|
| Duration of surgery, minutes, mean ± SD | 106.9 ± 36.4 |

Values are presented as n (%) unless otherwise specified. ASA: American Society of Anesthesiologists; SD: standard deviation.

**Preoperative anxiety**

The mean Amsterdam Preoperative Anxiety and Information Scale anxiety subscore was 10.8 ± 3.9, with scores ranging from 4 to 19. Using a score of ≥11 to define clinically relevant anxiety, 26 (43.3%) patients were classified as having high anxiety, while 34 (56.7%) had low-to-moderate anxiety.

High anxiety was identified in 16 of 28 female patients (57.1%) and 10 of 32 male patients (31.3%). Female sex was significantly associated with high anxiety (p = 0.043). Patients without previous surgical experience showed a higher frequency of anxiety than those with prior surgical exposure, although the difference was not statistically significant (p = 0.053). Age, body mass index, ASA physical status, anaesthetic technique, surgical category, and operative duration did not differ significantly between the anxiety groups (Table 2).

**Table 2. Characteristics of patients according to preoperative anxiety status**

| Characteristic | High anxiety (n = 26) | Low-to-moderate anxiety (n = 34) | p-value |
|---|---|---|---|
| Age, years, mean ± SD | 44.2 ± 13.1 | 48.8 ± 13.6 | 0.190 |
| Female sex | 16 (61.5) | 12 (35.3) | 0.043 |
| Body mass index, kg/m² | 25.2 ± 3.8 | 25.6 ± 4.1 | 0.698 |
| Previous surgical experience | 8 (30.8) | 19 (55.9) | 0.053 |
| ASA physical status II-III | 15 (57.7) | 16 (47.1) | 0.416 |
| General anaesthesia | 18 (69.2) | 18 (52.9) | 0.202 |
| Major surgery | 14 (53.8) | 12 (35.3) | 0.151 |
| Duration of surgery, minutes | 112.0 ± 38.0 | 103.0 ± 35.0 | 0.351 |

Values are presented as n (%) or mean ± SD. ASA: American Society of Anesthesiologists; SD: standard deviation.

**Postoperative pain severity**

For the entire cohort, the mean Numerical Rating Scale pain score was 5.1 ± 1.8 at 2 hours, 4.4 ± 1.7 at 6 hours, 3.5 ± 1.5 at 12 hours, and 2.5 ± 1.3 at 24 hours. Pain intensity decreased progressively across the four postoperative assessments (p < 0.001).

Patients with high preoperative anxiety reported greater pain at every assessment. At 2 hours, the mean score was 6.2 ± 1.4 in the high-anxiety group compared with 4.2 ± 1.5 in the low-to-moderate-anxiety group (p < 0.001). The corresponding scores remained significantly higher at 6, 12, and 24 hours. Moderate-to-severe pain at 6 hours occurred in 22 (84.6%) patients with high anxiety and 15 (44.1%) with low-to-moderate anxiety (p = 0.001). At 24 hours, it remained present in 10 (38.5%) and 4 (11.8%) patients, respectively (p = 0.015), as shown in Table 3.

**Table 3. Postoperative pain and analgesic requirements according to preoperative anxiety status**

| Postoperative outcome | High anxiety (n = 26) | Low-to-moderate anxiety (n = 34) | p-value |
|---|---|---|---|
| Pain score at 2 hours | 6.2 ± 1.4 | 4.2 ± 1.5 | <0.001 |
| Pain score at 6 hours | 5.4 ± 1.3 | 3.6 ± 1.4 | <0.001 |
| Pain score at 12 hours | 4.3 ± 1.4 | 2.9 ± 1.3 | <0.001 |
| Pain score at 24 hours | 3.1 ± 1.3 | 2.1 ± 1.1 | 0.003 |
| Moderate-to-severe pain at 6 hours | 22 (84.6) | 15 (44.1) | 0.001 |
| Moderate-to-severe pain at 24 hours | 10 (38.5) | 4 (11.8) | 0.015 |
| Rescue analgesia required | 21 (80.8) | 14 (41.2) | 0.002 |
| Time to first rescue analgesia, minutes | 126 ± 48 | 202 ± 72 | <0.001 |
| Twenty-four-hour opioid consumption, morphine equivalents, mg | 12.8 ± 5.1 | 7.1 ± 4.3 | <0.001 |

Values are presented as n (%) or mean ± SD. Moderate-to-severe pain was defined as a Numerical Rating Scale score ≥4. SD: standard deviation.

**Analgesic requirements**

Overall, 35 (58.3%) patients required at least one dose of rescue analgesia during the first 24 postoperative hours. The requirement was significantly higher among patients with high anxiety than among those with low-to-moderate anxiety (80.8% versus 41.2%; p = 0.002).

The mean time to the first rescue analgesic dose was shorter in the high-anxiety group (126 ± 48 minutes) than in the low-to-moderate-anxiety group (202 ± 72 minutes; p < 0.001). Mean cumulative opioid consumption during the first 24 hours was also higher among patients with high anxiety (12.8 ± 5.1 versus 7.1 ± 4.3 mg intravenous morphine equivalents; p < 0.001) (Table 3).

**Correlation between anxiety and postoperative pain**

Preoperative anxiety scores demonstrated significant positive correlations with postoperative pain at all assessment points. The strongest relationship was observed at 2 hours (r = 0.61; p < 0.001), followed by 6 hours (r = 0.58; p < 0.001), 12 hours (r = 0.49; p < 0.001), and 24 hours (r = 0.39; p = 0.002). Thus, higher anxiety was associated with greater early postoperative pain, while the strength of the relationship declined over time.

**Multivariable analysis**

A multivariable linear regression model was constructed using the 6-hour pain score as the dependent variable. Preoperative anxiety score, age, sex, anaesthetic technique, and surgical category were included as predictors. After adjustment, each one-point increase in the anxiety score was associated with a 0.22-point increase in the 6-hour pain score (B = 0.22; 95% confidence interval: 0.12-0.32; p < 0.001). Major surgery was also independently associated with higher pain (B = 0.84; 95% confidence interval: 0.24-1.44; p = 0.007). Age, sex, and anaesthetic technique were not independent predictors. The model explained 46% of the variance in pain severity, with an adjusted $R^2$ of 0.41 (overall p < 0.001) (Table 4).

**Table 4. Multivariable linear regression analysis of factors associated with the 6-hour postoperative pain score**

| Predictor | Regression coefficient, B | 95% confidence interval | Standardized β | p-value |
|---|---|---|---|---|
| Preoperative anxiety score | 0.22 | 0.12 to 0.32 | 0.49 | <0.001 |
| Major surgery | 0.84 | 0.24 to 1.44 | 0.25 | 0.007 |
| Female sex | 0.43 | −0.15 to 1.01 | 0.13 | 0.145 |
| General anaesthesia | 0.37 | −0.22 to 0.96 | 0.11 | 0.214 |
| Age, per year | −0.01 | −0.03 to 0.02 | −0.06 | 0.512 |

Model $R^2 = 0.46$; adjusted $R^2 = 0.41$; overall model $p < 0.001$.

## Discussion

The present study demonstrated that clinically relevant preoperative anxiety affected 43.3% of adults undergoing elective surgery. Patients with high anxiety reported consistently greater postoperative pain, required rescue analgesia more frequently, received the first rescue dose earlier, and consumed more opioids during the first 24 hours. Anxiety remained independently associated with the 6-hour pain score after adjustment for age, sex, anaesthetic technique, and surgical category. These findings support the concept that psychological state before surgery contributes meaningfully to acute postoperative pain beyond procedural characteristics alone.

The observed anxiety prevalence is comparable with reports from other elective surgical populations. Bedaso and Ayalew documented preoperative anxiety in 47% of adult patients, while Eberhart et al. reported high anxiety in approximately two-fifths of a large surgical cohort.1,2 Differences between studies reflect variation in patient characteristics, cultural context, surgical procedures, assessment timing, and anxiety instruments. In the current analysis, female patients showed a higher frequency of high anxiety. This pattern is consistent with Caumo et al., who identified female sex as an independent risk factor, and with the findings of Aust et al. and Eberhart et al.11,12 Previous surgical experience showed a protective tendency, although the association was not statistically significant, possibly because prior uneventful exposure reduces uncertainty concerning anaesthesia and postoperative recovery. The association between anxiety and pain was strongest at 2 hours and gradually weakened by 24 hours. Early postoperative pain is closely influenced by anticipatory distress, immediate surgical nociception, emergence from anaesthesia, and the patient's interpretation of bodily sensations. Kain et al. showed that preoperative state anxiety directly predicted immediate pain after hysterectomy and indirectly influenced later pain.5 Granot and Ferber also observed significant correlations between anxiety-related psychological variables and postoperative pain intensity.6 The present findings extend these observations across a mixed elective surgical population and demonstrate a temporal reduction in the strength of correlation as tissue-related and analgesic factors increasingly shape pain during recovery.

Higher rescue analgesic use and opioid consumption among anxious patients are clinically relevant. Vaughn et al. described the potential value of anxiety assessment for identifying patients at risk of postoperative pain, while Bradshaw et al. found significant relationships between preoperative psychological status and pain after elective surgery.13,14 Systematic evidence likewise identifies anxiety and psychological distress as predictors of both postoperative pain and analgesic consumption.7,8 Greater sympathetic arousal, focused attention on pain, reduced confidence in coping, and catastrophic expectations can amplify perceived pain and prompt earlier requests for analgesia. Major surgery was independently associated with the 6-hour pain score, which is expected because tissue injury and nociceptive input vary with procedural extent. Nevertheless, anxiety retained a significant effect after adjustment, indicating that it should not be regarded as a minor emotional response. Brief screening during preanaesthetic evaluation can identify vulnerable patients without disrupting clinical workflow. Targeted education, clarification of anaesthetic concerns, relaxation strategies, and individualized multimodal analgesia could improve perioperative experience. Future multicentre studies should evaluate whether structured anxiety-reduction interventions produce measurable reductions in pain and opioid exposure.

### LIMITATIONS

This study was conducted at a single centre with a modest sample, limiting external validity and the precision of subgroup comparisons. Surgical procedures and anaesthetic techniques were heterogeneous, although these factors were considered during adjusted analysis. Anxiety was measured once, and unmeasured factors such as pain catastrophizing, sleep quality, social support, and pre-existing subclinical depression could have influenced postoperative pain reporting.

### Conclusion

Preoperative anxiety was present in more than two-fifths of adults undergoing elective surgery and showed a clear association with postoperative pain. Highly anxious patients experienced greater pain throughout the first 24 hours, required rescue analgesia more often, received it earlier, and consumed larger opioid doses. The anxiety score independently predicted pain at 6 hours even after adjustment for demographic, anaesthetic, and surgical factors. These findings support routine psychological assessment during preanaesthetic evaluation. The Amsterdam Preoperative Anxiety and Information Scale offers a brief and practical screening approach. Early counselling, clear procedural information, reassurance, and individualized multimodal analgesic planning should be integrated into perioperative care for patients identified as having elevated anxiety.

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