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Original Research Article

Effect of Preoperative Anxiety on Postoperative Pain and Recovery

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Abstract:

Background: Preoperative anxiety is common among surgical patients and may adversely influence postoperative pain, analgesic requirements and recovery. This study evaluated the association of preoperative anxiety with postoperative pain and quality of recovery following elective surgery.

Methods: This prospective observational cohort study included 137 adults aged 18–65 years undergoing elective surgery under general anaesthesia. Preoperative anxiety was assessed using the Amsterdam Preoperative Anxiety and Information Scale (APAIS); a score ≥11 indicated clinically significant anxiety. Postoperative pain was evaluated using the Numerical Rating Scale during the first 24 hours. Opioid consumption, recovery parameters and 24-hour Quality of Recovery-15 (QoR-15) scores were recorded.

Results: Preoperative anxiety was identified in 58 (42.3%) patients. Anxious patients had higher mean 24-hour pain scores than non-anxious patients (3.6±1.0 vs. 2.5±0.9; $p<0.001$), and moderate-to-severe pain was more frequent (74.1% vs. 39.2%; $p<0.001$). They also had higher 24-hour morphine-equivalent consumption (13.6±5.2 vs. 8.4±4.1 mg; $p<0.001$), longer post-anaesthesia care unit stays and lower QoR-15 scores (112.4±13.8 vs. 126.8±12.1; $p<0.001$). APAIS scores correlated positively with pain ($r=0.52$) and opioid consumption ($r=0.46$) and negatively with QoR-15 scores ($r=-0.58$). Preoperative anxiety remained an independent predictor of pain and poorer recovery after adjustment for relevant confounders.

Conclusion: Preoperative anxiety was independently associated with greater postoperative pain, increased opioid consumption and poorer recovery. Routine anxiety screening and targeted interventions may improve perioperative outcomes.

Keywords: Preoperative Anxiety; Postoperative Pain; Quality Of Recovery; APAIS; QoR-15; Opioid Consumption.

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Introduction

Surgery and anaesthesia are frequently perceived as stressful events, and many patients experience anxiety while awaiting an operation. Preoperative anxiety is characterised by apprehension, tension or fear related to anaesthesia, surgical complications, postoperative pain, loss of control and uncertainty regarding the outcome. Its prevalence varies considerably according to the patient population, type of surgery, assessment instrument and threshold used to define anxiety.[1] Although mild anxiety may represent a normal adaptive response, moderate-to-severe anxiety can produce clinically important physiological and psychological changes during the perioperative period.

Preoperative anxiety activates the sympathetic nervous system and hypothalamic–pituitary–adrenal axis, resulting in tachycardia, hypertension, increased myocardial oxygen demand and heightened neuroendocrine stress responses. Psychologically, anxiety may increase attention to painful stimuli, promote pain catastrophising and reduce the patient's ability to cope with postoperative discomfort. Consequently, anxious patients may perceive surgical pain more intensely and require greater quantities of anaesthetic or analgesic medication. A systematic review by Ip et al. identified preoperative anxiety, pre-existing pain, younger age and type of surgery as important predictors of postoperative pain.[2] Similarly, Kalkman et al. demonstrated that preoperative anxiety contributed to the prediction of severe pain immediately after emergence from general

anaesthesia.[3] Vaughn et al. further reported that preoperative state anxiety accounted for a considerable proportion of the variation in postoperative pain intensity.[4]

Clinical evidence across different surgical populations supports this relationship. Ali et al. observed that patients with greater anxiety before laparoscopic cholecystectomy had higher postoperative analgesic requirements and less favourable anaesthetic recovery.[5] Among living kidney donors, Türksal et al. found that higher anxiety scores were associated with delayed spontaneous respiration, extubation and discharge from the post-anaesthesia care unit, as well as greater pain and analgesic consumption during the first 24 postoperative hours.[6] Likewise, a prospective cardiac-surgery study reported that increasing preoperative state anxiety was associated with increased postoperative morphine requirements, even after accounting for relevant clinical and procedural factors.[7] These findings indicate that anxiety may influence both the subjective perception of pain and objective indicators such as analgesic consumption and recovery time.

Postoperative recovery is, however, a broader and multidimensional outcome encompassing physical comfort, emotional well-being, functional independence, sleep, nausea and vomiting, pain control and the ability to resume normal activities. Gümüş reported that increased perioperative anxiety was associated with poorer Quality of Recovery-40 scores following abdominal surgery.[8] Gu et al. similarly found that preoperative anxiety was associated with greater postoperative pain, sleep disturbance and impaired early recovery after laparoscopic gynaecological surgery.[9] Poor pain control and delayed recovery may, in turn, restrict mobilisation, disturb sleep, reduce patient satisfaction and prolong hospital stay, thereby increasing healthcare utilisation.

Despite these observations, the relationship is not uniform across all surgical populations. Postoperative pain and recovery are affected by several interacting factors, including the type and duration of surgery, anaesthetic technique, pre-existing pain, age, sex, comorbidities, opioid exposure and perioperative analgesic protocol. A recent systematic review and meta-analysis found that preoperative anxiety was associated with several adverse perioperative outcomes and delayed recovery, although the pooled relationship with postoperative pain was not consistently significant.[10] Differences in anxiety-measurement instruments, surgical procedures and outcome-assessment periods may partly explain these inconsistent findings.

Preoperative anxiety is potentially identifiable and modifiable through routine screening, appropriate counselling, patient education, psychological preparation and pharmacological or non-pharmacological anxiolytic interventions. Establishing its association with postoperative pain and recovery could therefore assist anaesthesiologists in recognising high-risk patients, individualising perioperative analgesia and implementing targeted anxiety-reduction strategies. Hence, the present study aims to evaluate the effect of preoperative anxiety on postoperative pain intensity, analgesic requirements and the quality of postoperative recovery among patients undergoing surgery.

Materials and Method

This prospective observational cohort study was conducted in the Department of Anaesthesiology at a tertiary-care teaching hospital over 12 months. The study evaluated the association of preoperative anxiety with postoperative pain, analgesic consumption and quality of recovery among adult patients undergoing elective surgery under general anaesthesia.

Study Population: Adult patients scheduled for elective surgery under general anaesthesia were screened during the pre-anaesthetic evaluation.

Inclusion Criteria: Patients aged 18–65 years, belonging to American Society of Anesthesiologists physical status I–III and undergoing elective surgery under general anaesthesia with an anticipated duration of at least 60 minutes were included. Patients who could understand and respond to the anxiety, pain and recovery questionnaires and who provided written informed consent were enrolled.

Exclusion Criteria: Patients undergoing emergency surgery and those with cognitive impairment, psychosis, communication difficulties, chronic pain lasting more than three months, regular opioid use or substance dependence were excluded. Patients receiving anxiolytic, antidepressant or antipsychotic medications were also excluded. Other exclusion criteria included regional anaesthesia as the sole anaesthetic technique, planned postoperative mechanical ventilation, intensive care admission, reoperation, major postoperative complications preventing outcome assessment and refusal to participate.

Sample Size: The sample size was calculated to detect a minimum correlation coefficient of 0.25 between preoperative anxiety and postoperative pain. At a 5% level of significance and 80% statistical power, the minimum required sample was 123 patients. After accounting for a possible 10% loss to follow-up or incomplete observations, the final sample size was determined as 137 patients.

Sampling Technique: Eligible patients were recruited using consecutive sampling until the required sample size was achieved.

Preoperative Assessment: A detailed history and clinical examination were performed during the pre-anaesthetic visit. Information regarding age, sex, body mass index, educational status, ASA physical status, previous surgical and anaesthetic exposure, history of preoperative pain and relevant comorbidities was recorded. The type and expected duration of surgery were also documented. Baseline heart rate, blood pressure and peripheral oxygen saturation were measured.

All patients received routine preoperative information according to the institutional protocol. No additional anxiolytic intervention was administered solely for the study.

Assessment of Preoperative Anxiety: Preoperative anxiety was evaluated on the evening before surgery or at least two hours before induction of anaesthesia using the Amsterdam Preoperative Anxiety and Information Scale (APAIS). The APAIS consisted of six items rated from 1 to 5. Four items assessed anxiety related to anaesthesia and surgery and provided a combined anxiety score ranging from 4 to 20. The remaining two items assessed the patient's need for information.

An APAIS anxiety score of 11 or higher was considered clinically significant anxiety. Based on the score, the patients were classified into two groups:

- **Non-anxious Group:** APAIS anxiety score <11
- **Anxious Group:** APAIS anxiety score ≥11

The APAIS anxiety score was also analysed as a continuous variable. Anxiety was additionally recorded using a 0–10 visual analogue anxiety scale for simple clinical interpretation.

Anaesthetic Technique: All patients followed the standard institutional fasting and premedication protocols. Routine intraoperative monitoring included non-invasive blood pressure, electrocardiography, pulse oximetry, end-tidal carbon dioxide and neuromuscular monitoring whenever indicated.

General anaesthesia was induced using a standard intravenous induction agent, an opioid and a neuromuscular blocking drug. Anaesthesia was maintained using an inhalational or intravenous anaesthetic technique according to institutional practice. Intraoperative haemodynamic variables, anaesthetic agents, opioid doses, duration of anaesthesia, duration of surgery and intraoperative complications were recorded.

A standard multimodal postoperative analgesic protocol consisting of paracetamol and a non-steroidal anti-inflammatory drug was followed unless contraindicated. Rescue opioids were administered according to the postoperative pain score. All opioid doses were converted into intravenous morphine-equivalent doses for statistical analysis.

Assessment of Postoperative Pain: Postoperative pain intensity was assessed using an 11-point Numerical Rating Scale, where 0 represented "no pain" and 10 represented "the worst imaginable pain." Pain was evaluated on arrival in the post-anaesthesia care unit and at 2, 6, 12 and 24 hours after surgery. Pain was assessed both at rest and during movement or coughing whenever clinically appropriate.

A pain score of 4 or greater was considered moderate-to-severe pain and was treated with rescue analgesia according to the institutional protocol. The mean postoperative pain score, highest pain score during the first 24 hours, presence of moderate-to-severe pain, time to first rescue analgesic request, number of rescue analgesic doses and total opioid consumption during the first 24 hours were recorded.

Assessment of Postoperative Recovery: The quality of postoperative recovery was evaluated using the 15-item Quality of Recovery questionnaire (QoR-15) at 24 hours after surgery. The QoR-15 assessed five domains: physical comfort, emotional state, physical independence, psychological support and pain. Each item was scored from 0 to 10, giving a total score ranging from 0 to 150. A higher QoR-15 score indicated better postoperative recovery.

Other recovery-related parameters recorded included time to eye opening, response to verbal commands, time to tracheal extubation and duration of stay in the post-anaesthesia care unit. Postoperative nausea and vomiting, time to first oral intake, time to mobilisation, sleep quality during the first postoperative night, length of postoperative hospital stay and patient satisfaction were also documented.

Statistical Analysis: Data were analysed using SPSS. Continuous variables were presented as mean ± standard deviation or median with interquartile range, while categorical variables were expressed as frequencies and percentages. Appropriate parametric or non-parametric tests were used for group comparisons. Correlation and multivariable regression analyses were performed to assess the association of preoperative anxiety with postoperative pain, opioid consumption and QoR-15 scores. A p value <0.05 was considered statistically significant.

Observation and Results

Table 1: Baseline characteristics of the study participants

Characteristic	Anxious group (n=58)	Non-anxious group (n=79)	p value
Age, years	43.8 ± 10.9	45.1 ± 11.5	0.506
Female sex	35 (60.3%)	39 (49.4%)	0.204
BMI, kg/m²	24.9 ± 3.6	24.4 ± 3.4	0.408
ASA physical status I	22 (37.9%)	34 (43.0%)	0.717
ASA physical status II	29 (50.0%)	37 (46.8%)	
ASA physical status III	7 (12.1%)	8 (10.1%)	
Previous surgical experience	25 (43.1%)	39 (49.4%)	0.468
Preoperative pain score	1.2 ± 1.1	1.0 ± 1.0	0.271
Duration of surgery, minutes	108.6 ± 36.4	104.3 ± 38.1	0.508
Duration of anaesthesia, minutes	128.7 ± 39.5	124.1 ± 40.3	0.508
Intraoperative opioid dose, morphine equivalent (mg)	8.1 ± 2.4	7.9 ± 2.3	0.622

There were no statistically significant differences between the anxious and non-anxious groups regarding age, sex, BMI, ASA physical status, previous surgical experience, preoperative pain, duration of surgery or intraoperative opioid administration. Therefore, the two groups were comparable in their baseline clinical and operative characteristics.

The mean APAIS anxiety score was significantly higher among anxious patients than among non-anxious patients (13.8 ± 2.1 versus 7.1 ± 1.7; p<0.001). The overall mean APAIS anxiety score was 9.9 ± 3.8.

Table 2: Postoperative pain scores during the first 24 hours

Postoperative time	Anxious group (n=58)	Non-anxious group (n=79)	p value
On arrival in PACU	4.8 ± 1.5	3.4 ± 1.4	<0.001
2 hours	4.5 ± 1.4	3.1 ± 1.3	<0.001
6 hours	3.8 ± 1.3	2.5 ± 1.2	<0.001
12 hours	3.0 ± 1.2	2.0 ± 1.1	<0.001
24 hours	2.1 ± 1.0	1.4 ± 0.9	<0.001
Mean 24-hour pain score	3.6 ± 1.0	2.5 ± 0.9	<0.001
Highest pain score	5.7 ± 1.3	4.2 ± 1.4	<0.001

Postoperative pain scores gradually decreased in both groups during the first 24 hours. However, anxious patients reported significantly higher pain scores at every assessment. Repeated-measures analysis demonstrated a significant effect of time (p<0.001), anxiety group (p<0.001) and time-by-anxiety interaction (p=0.018).

Moderate-to-severe postoperative pain was observed in 43 (74.1%) anxious patients compared with 31 (39.2%) non-anxious patients (p<0.001). The unadjusted odds of developing moderate-to-severe pain were 4.44 times higher among anxious patients (95% CI: 2.12–9.32).

Table 3: Postoperative analgesic requirements

Analgesic outcome	Anxious group (n=58)	Non-anxious group (n=79)	p value
Patients requiring rescue analgesia	47 (81.0%)	43 (54.4%)	0.001
Time to first rescue analgesia, minutes	42 (30–60)	68 (45–95)	<0.001
Number of rescue doses	1.8 ± 0.9	1.1 ± 0.8	<0.001
Total 24-hour opioid consumption, morphine equivalent (mg)	13.6 ± 5.2	8.4 ± 4.1	<0.001

A significantly higher proportion of anxious patients required rescue analgesia. The anxious group requested analgesia earlier and received more rescue doses. Total 24-hour opioid consumption was also significantly higher among anxious patients.

Table 4: Postoperative recovery outcomes

Recovery outcome	Anxious group (n=58)	Non-anxious group (n=79)	p value
Time to eye opening, minutes	9.8 ± 3.2	8.4 ± 2.9	0.009
Time to extubation, minutes	13.6 ± 4.1	11.8 ± 3.7	0.008
PACU stay, minutes	78.4 ± 20.6	62.3 ± 18.7	<0.001
QoR-15 score at 24 hours	112.4 ± 13.8	126.8 ± 12.1	<0.001
Postoperative nausea and vomiting	17 (29.3%)	12 (15.2%)	0.046
Time to oral intake, hours	6.5 ± 2.4	5.7 ± 2.2	0.045
Time to mobilisation, hours	8.6 ± 2.8	7.2 ± 2.5	0.003
Hospital stay, days	3.2 ± 1.3	2.7 ± 1.1	0.016
Patient satisfaction score	7.6 ± 1.2	8.5 ± 1.0	<0.001

The anxious group had significantly longer times to eye opening, extubation and PACU discharge. Their mean QoR-15 score was significantly lower, indicating poorer postoperative recovery. Preoperative anxiety was also associated with delayed oral intake and mobilisation, a higher incidence of postoperative nausea and vomiting, longer hospital stay and lower patient satisfaction.

Table 5: Correlation of APAIS anxiety scores with postoperative outcomes

Postoperative outcome	Correlation coefficient (r)	p value
Mean 24-hour pain score	0.52	<0.001
Highest postoperative pain score	0.49	<0.001
Total opioid consumption	0.46	<0.001
PACU duration	0.34	<0.001
QoR-15 score	−0.58	<0.001
Patient satisfaction score	−0.41	<0.001

The APAIS anxiety score showed a moderately strong positive correlation with postoperative pain and opioid consumption. It was negatively correlated with the QoR-15 and patient satisfaction scores. Thus, increasing preoperative anxiety was associated with greater postoperative pain, increased analgesic requirements and poorer recovery.

Table 6: Multivariable analysis of postoperative outcomes

Outcome	Adjusted effect estimate	95% CI	p value
Mean 24-hour pain score	B = 0.13 per APAIS point	0.09–0.17	<0.001
Total opioid consumption	B = 0.52 mg per APAIS point	0.29–0.75	<0.001
QoR-15 score	B = −1.55 per APAIS point	−1.98 to −1.12	<0.001
Moderate-to-severe pain	AOR = 1.22 per APAIS point	1.10–1.36	<0.001

B: regression coefficient; AOR: adjusted odds ratio; CI: confidence interval.

Each one-point increase in the APAIS anxiety score was associated with a 0.13-point increase in mean postoperative pain, an additional 0.52 mg of morphine-equivalent opioid consumption and a 1.55-point reduction in the QoR-15 score. Each one-point increase in anxiety score increased the adjusted odds of moderate-to-severe postoperative pain by 22%.

Discussion

The present study evaluated the influence of preoperative anxiety on postoperative pain, analgesic requirements and quality of recovery among 137 patients undergoing elective surgery. Clinically significant preoperative anxiety was observed in 42.3% of patients. Anxious patients experienced significantly higher pain scores throughout the first 24 postoperative hours, required earlier and more frequent rescue analgesia, consumed more opioids and demonstrated poorer postoperative recovery. Preoperative anxiety remained independently associated with postoperative pain, opioid consumption and QoR-15 scores after adjustment for demographic, clinical and surgical factors.

The observed prevalence of preoperative anxiety was comparable with findings reported in Indian surgical populations. Suresh and Lakshminarasimhan reported a prevalence of 36% among 112 patients undergoing elective lower-segment caesarean section in South India.[11] In contrast, Shreya et al. documented preoperative anxiety in 63.9% of patients scheduled for cardiothoracic surgery.[12] The higher prevalence in their study may be explained by the greater perceived risk of cardiothoracic procedures, fear of postoperative mechanical ventilation and concern regarding surgical outcomes. Differences in surgical

populations, socioeconomic characteristics, assessment timing and anxiety thresholds may account for variation across studies.

Postoperative pain scores were significantly higher among anxious patients at every assessment. The mean 24-hour pain score was 3.6 ± 1.0 in the anxious group compared with 2.5 ± 0.9 in the non-anxious group. Moreover, 74.1% of anxious patients experienced moderate-to-severe pain compared with 39.2% of non-anxious patients. The APAIS anxiety score demonstrated a moderately strong positive correlation with mean postoperative pain ($r=0.52$). These findings were consistent with the South Indian study by Suresh and Lakshminarasimhan, who reported a significant positive correlation between preoperative anxiety and postoperative pain after caesarean section ($r=0.25$, $p<0.01$).[11] The stronger correlation in the present study might be related to the inclusion of patients undergoing different surgical procedures under general anaesthesia, some of which were associated with greater tissue injury and pain.

Similar findings were reported by Shreya et al. in an Indian prospective observational study of 122 cardiothoracic surgical patients. They found that patients with significant preoperative anxiety had higher postoperative pain scores at 20 and 24 hours and required greater doses of postoperative analgesics.[12] The current findings therefore extend the association between anxiety and pain beyond specific surgical populations and demonstrate that anxiety may remain an independent predictor even after controlling for preoperative pain, surgical duration and intraoperative opioid administration.

Preoperative anxiety may increase postoperative pain through heightened sympathetic activity, increased vigilance towards painful stimuli and reduced pain threshold and tolerance. Padhy et al., in a study conducted among Indian patients undergoing elective gastrointestinal surgery, demonstrated that the stress associated with impending surgery significantly reduced pain threshold and pain tolerance.[13] They also observed that anxiety, previous painful experiences and sex influenced contextual pain perception. Similarly, Angadi et al. reported that greater preoperative pain sensitivity independently predicted postoperative pain severity and analgesic requirements among Indian patients undergoing lumbar fusion surgery.[14] These observations support a biopsychological mechanism through which anxiety and surgical stress increase pain sensitivity and contribute to greater postoperative discomfort.

The influence of anxiety was also evident from analgesic consumption. Anxious patients required rescue analgesia more frequently, requested the first rescue dose earlier and consumed significantly more morphine-equivalent opioid during the first 24 hours. Each one-point increase in the APAIS score was associated with an additional 0.52 mg of morphine-equivalent consumption. This finding was consistent with the systematic review by Ip et al., which identified preoperative anxiety, pre-existing pain, age and type of surgery as important predictors of postoperative pain and analgesic consumption.[2] Increased opioid requirements among anxious patients could further contribute to nausea, vomiting, sedation and delayed mobilisation.

The association between anxiety and pain may be clinically modifiable. In an Indian randomised controlled trial, Kalliyath et al. found that structured preoperative education and an informational handout about spinal anaesthesia significantly reduced anxiety and postoperative pain among parturients undergoing elective caesarean section.[15] This finding suggests that routine anxiety screening followed by appropriate counselling and procedure-specific education may improve postoperative pain control. However, interventional studies are required to establish whether reducing the anxiety score directly decreases postoperative opioid requirements across different surgical populations.

In the present study, anxious patients also had delayed eye opening and extubation, longer PACU stays and lower QoR-15 scores. Similar findings were reported by Türksal et al., who observed that higher anxiety scores were associated with prolonged spontaneous respiration time, extubation time and PACU discharge, together with increased postoperative pain and analgesic use.[6] Gümüş also found that increased preoperative and postoperative anxiety was associated with poorer quality-of-recovery scores following abdominal surgery.[8] The lower QoR-15 score among anxious patients in the present study indicated that anxiety affected not only pain but also physical comfort, emotional well-being, physical independence and psychological support.

The anxious group also had a higher incidence of postoperative nausea and vomiting, delayed oral intake and mobilisation, longer hospital stay and lower patient satisfaction. These findings may be partly mediated by greater postoperative pain and opioid consumption. Pain restricts mobilisation and effective coughing, while opioid-related nausea and sedation may delay oral intake and functional recovery. Psychological distress may additionally reduce motivation and confidence during rehabilitation. The negative correlation between anxiety and QoR-15 scores ($r=-0.58$) indicated that increasing anxiety was associated with progressively poorer recovery.

The absence of significant baseline differences between the two groups strengthened the observed association. Age, sex, BMI, ASA status, previous surgical exposure, preoperative pain, surgical duration and intraoperative opioid dose were comparable. Suresh and Lakshminarasimhan similarly found no significant association between preoperative anxiety and the evaluated sociodemographic characteristics.[11] Nevertheless, the effect of anxiety remained clinically important, demonstrating that psychological assessment provides information beyond routinely recorded demographic and clinical variables.

The study findings have practical implications for perioperative care. The APAIS is brief and can be incorporated into routine pre-anaesthetic assessment. Patients with scores of 11 or higher may benefit from detailed counselling, clarification of anaesthesia-related concerns, relaxation techniques, music therapy or appropriate pharmacological anxiolysis. Identifying anxiety before surgery may allow individualised multimodal analgesia, closer postoperative pain monitoring and early implementation of recovery-promoting measures.

The study had certain limitations. Its observational design established an association but could not confirm a causal relationship between anxiety and postoperative outcomes. It was conducted at a single centre and included different types of surgery, which may have introduced procedural heterogeneity. Anxiety was assessed using a self-reported scale and could have been affected by the timing of assessment. Other psychological factors such as depression, pain catastrophising, sleep disturbance and social support were not separately evaluated. Pain and opioid consumption were assessed only during the first 24 hours; therefore, the effect of anxiety on persistent postsurgical pain could not be determined.

Conclusion

Preoperative anxiety was common and was independently associated with higher postoperative pain, increased opioid consumption and poorer quality of recovery. Anxious patients also experienced delayed anaesthetic recovery, longer PACU and hospital stays, more postoperative nausea and vomiting and lower satisfaction. Routine preoperative anxiety screening and targeted anxiety-reduction interventions may contribute to better pain control and enhanced postoperative recovery.

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