



Original Research Article

Association Between Preoperative Anxiety Scores and Postoperative Pain Severity in Elective Surgical Patients: A Systematic Review.

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Abstract: *Background:* Preoperative anxiety is common among patients undergoing elective surgery and may influence postoperative pain intensity, analgesic requirements, recovery, and patient satisfaction. However, the reported association varies because of differences in anxiety-assessment instruments, surgical procedures, anaesthetic techniques, analgesic protocols, and postoperative pain-assessment intervals. *Objective:* To systematically evaluate the association between validated preoperative anxiety scores and postoperative pain severity among adults undergoing elective surgery. *Methods:* This systematic review was conducted and reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses 2020 guidelines. MEDLINE/PubMed, Embase, Scopus, Web of Science, PsycINFO, and the Cochrane Library were searched from database inception to 30 January 2026. Eligible studies included adults undergoing elective surgery, assessed anxiety before anaesthesia using a validated instrument, measured postoperative pain using a recognised pain scale, and evaluated the association between anxiety and pain severity or analgesic use. Two reviewers independently screened records, extracted data, and assessed methodological quality using the Quality in Prognosis Studies tool. Owing to substantial clinical and methodological heterogeneity, findings were synthesised narratively. *Results:* The search identified 504 records. After removal of 137 duplicates, 367 records underwent title and abstract screening, and 58 full-text reports were assessed for eligibility. Forty-one reports were excluded, leaving 17 primary observational studies for qualitative synthesis. Fourteen studies reported that higher preoperative anxiety was associated with at least one adverse postoperative pain-related outcome, including greater early pain intensity, increased opioid or rescue-analgesia requirements, or a higher occurrence of moderate-to-severe pain. The association was most consistent during the first 12–24 postoperative hours. State anxiety demonstrated a clearer relationship with acute postoperative pain and analgesic use than trait anxiety. In several studies, however, the association weakened after adjustment for expected pain, catastrophising, depression, baseline pain, surgical severity, anaesthetic technique, or analgesic regimen. Five studies had a low overall risk of bias, nine had a moderate risk, and three had a high risk. *Conclusion:* Higher preoperative anxiety is frequently associated with greater acute postoperative pain severity and increased analgesic requirements among adults undergoing elective surgery. The

	relationship appears strongest during the early postoperative period and is more consistent for state anxiety than for trait anxiety. Preoperative anxiety should be considered as part of a broader biopsychosocial pain-risk assessment. Routine screening may help identify patients who could benefit from targeted counselling, psychological preparation, closer postoperative monitoring, and individualised multimodal analgesia. Keywords: preoperative anxiety; postoperative pain; elective surgery; pain severity; analgesic consumption; state anxiety; trait anxiety; systematic review.
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INTRODUCTION

Postoperative pain remains an important clinical problem despite advances in anaesthesia, regional techniques, and multimodal analgesia. Inadequately controlled pain can interfere with mobilisation, respiration, sleep, rehabilitation, and patient satisfaction. Severe acute postoperative pain may also increase the risk of persistent postsurgical pain [3,4].

Postoperative pain is influenced by surgical tissue injury and by demographic, clinical, psychological, and treatment-related factors. Pre-existing pain, age, sex, previous opioid exposure, surgical procedure, anaesthetic technique, pain expectations, depression, catastrophising, and anxiety may all contribute to the postoperative pain experience [4,5].

Preoperative anxiety refers to apprehension, fear, tension, or worry occurring before surgery. Patients may be concerned about anaesthesia, postoperative pain, complications, disability, loss of control, or death. Anxiety may increase sympathetic activation, alter nociceptive processing, reduce pain tolerance, disrupt sleep, and heighten attention to painful sensations [5,6].

The State-Trait Anxiety Inventory is one of the most frequently used instruments in perioperative research. It distinguishes state anxiety, representing a temporary emotional response, from trait anxiety, representing a relatively stable tendency toward anxiety. The Amsterdam Preoperative Anxiety and Information Scale was developed specifically for surgical patients and separately evaluates concerns related to anaesthesia and surgery [6].

Several studies have reported greater postoperative pain and analgesic consumption among patients with high anxiety. Tadesse et al. observed higher pain scores at 2, 4, 6, and 12 hours after elective surgery among highly anxious patients [7]. However, other studies have suggested that expected pain, pain catastrophising, or baseline pain may be stronger independent predictors than general anxiety [8].

The available evidence is heterogeneous and requires systematic synthesis. This review therefore examines whether higher validated preoperative anxiety scores are associated with greater postoperative pain severity in elective surgical patients.

Review question

Among adults undergoing elective surgery, are higher preoperative anxiety scores associated with greater postoperative pain severity than lower anxiety scores?

Objectives

The primary objective was to evaluate the association between preoperative anxiety and postoperative pain severity during the first 24 hours after elective surgery.

The secondary objectives were to examine:

- Pain between 24 and 72 hours.
- Moderate-to-severe postoperative pain.
- Opioid and non-opioid analgesic consumption.
- Rescue-analgesia requirements.
- State anxiety compared with trait anxiety.
- Differences among surgical specialties and anaesthetic techniques.
- Associations adjusted for depression, catastrophising, expected pain, and baseline pain.
- Chronic postsurgical pain where reported.

METHODOLOGY

Review design

This systematic review was conducted and reported according to PRISMA 2020 [1,2]. The review involved a structured search, predefined eligibility criteria, duplicate screening, standardised data extraction, risk-of-bias assessment, and narrative evidence synthesis.

Eligibility criteria

Studies were eligible when they:

- Included adults aged 18 years or older.
- Investigated patients undergoing elective surgery.
- Measured anxiety before induction of anaesthesia.
- Used a validated anxiety-assessment instrument.

- Reported postoperative pain using a recognised pain scale.
 - Evaluated an association between anxiety and pain severity or analgesic requirements.
 - Used a prospective or retrospective analytical observational design.
- Emergency surgery, trauma surgery, paediatric populations, case reports, narrative reviews, editorials, conference abstracts without adequate data, and studies using unvalidated anxiety measures were excluded.

Information sources

The following databases were searched:

- MEDLINE/PubMed
- Embase
- Scopus
- Web of Science Core Collection
- PsycINFO
- Cochrane Library

Reference lists of eligible articles and relevant reviews were also examined. Forward citation searches were conducted through Scopus and Web of Science.

Search strategy

The search combined terms related to:

- Preoperative anxiety
- Validated anxiety instruments
- Elective surgery
- Postoperative pain
- Pain severity
- Analgesic consumption

A representative PubMed search was:

"Preoperative anxiety"[Title/Abstract]
OR "pre-operative anxiety"[Title/Abstract]
OR "presurgical anxiety"[Title/Abstract]
OR "State-Trait Anxiety Inventory"[Title/Abstract]
OR STAI [Title/Abstract]
OR "Amsterdam Preoperative Anxiety and
Information Scale"[Title/Abstract]
OR APAIS [Title/Abstract]
OR "Hospital Anxiety and Depression
Scale"[Title/Abstract]

AND

"postoperative pain"[Title/Abstract]
OR "postsurgical pain"[Title/Abstract]
OR "pain severity"[Title/Abstract]
OR "pain intensity"[Title/Abstract]
OR "analgesic consumption"[Title/Abstract]
OR "opioid consumption"[Title/Abstract]

AND

"elective surgery"[Title/Abstract]
OR "surgical patients"[Title/Abstract]
OR surgery[Title/Abstract]

RESULTS

Study selection

Two reviewers independently screened titles and abstracts. Potentially relevant reports underwent full-text assessment. Disagreements were resolved by consensus or consultation with a third reviewer. The identification, screening, eligibility, and inclusion processes were documented using a PRISMA 2020 flow diagram.

Data extraction

The following information was extracted:

- Author and year
- Country
- Study design
- Sample size
- Surgical procedure
- Participant characteristics
- Anaesthetic technique
- Anxiety instrument and assessment time
- Anxiety score or threshold
- Pain scale
- Postoperative assessment intervals
- Analgesic protocol
- Rescue analgesia
- Unadjusted and adjusted associations
- Confounding variables
- Study conclusions

Risk-of-bias assessment

The Quality in Prognosis Studies tool was used to assess:

- Study participation
- Study attrition
- Anxiety measurement
- Pain measurement
- Control of confounding
- Statistical analysis and reporting

Studies were classified as having low, moderate, or high risk of bias.

Evidence synthesis

A structured narrative synthesis was undertaken because the studies differed substantially in:

- Surgical population
- Anxiety instrument
- Anxiety threshold
- Pain scale
- Pain-assessment interval
- Anaesthetic technique
- Analgesic regimen
- Reported effect measure
- Adjustment for confounding

The studies were grouped by acute pain, analgesic consumption, surgical category, anxiety instrument, and chronic postsurgical pain. No pooled effect estimate was calculated.

Study Selection

The systematic search identified 486 records from six electronic databases:

- MEDLINE/PubMed: 126 records
- Embase: 104 records
- Scopus: 92 records
- Web of Science: 78 records
- PsycINFO: 48 records
- Cochrane Library: 38 records

An additional 18 records were identified through reference-list screening and forward citation searching, resulting in a total of 504 records.

After the removal of 137 duplicate records, 367 unique records underwent title and abstract screening. Of these, 309 were excluded because they did not evaluate preoperative anxiety, did not report postoperative pain outcomes, involved emergency or non-elective surgery, or represented reviews, protocols, editorials, conference abstracts, or non-clinical publications.

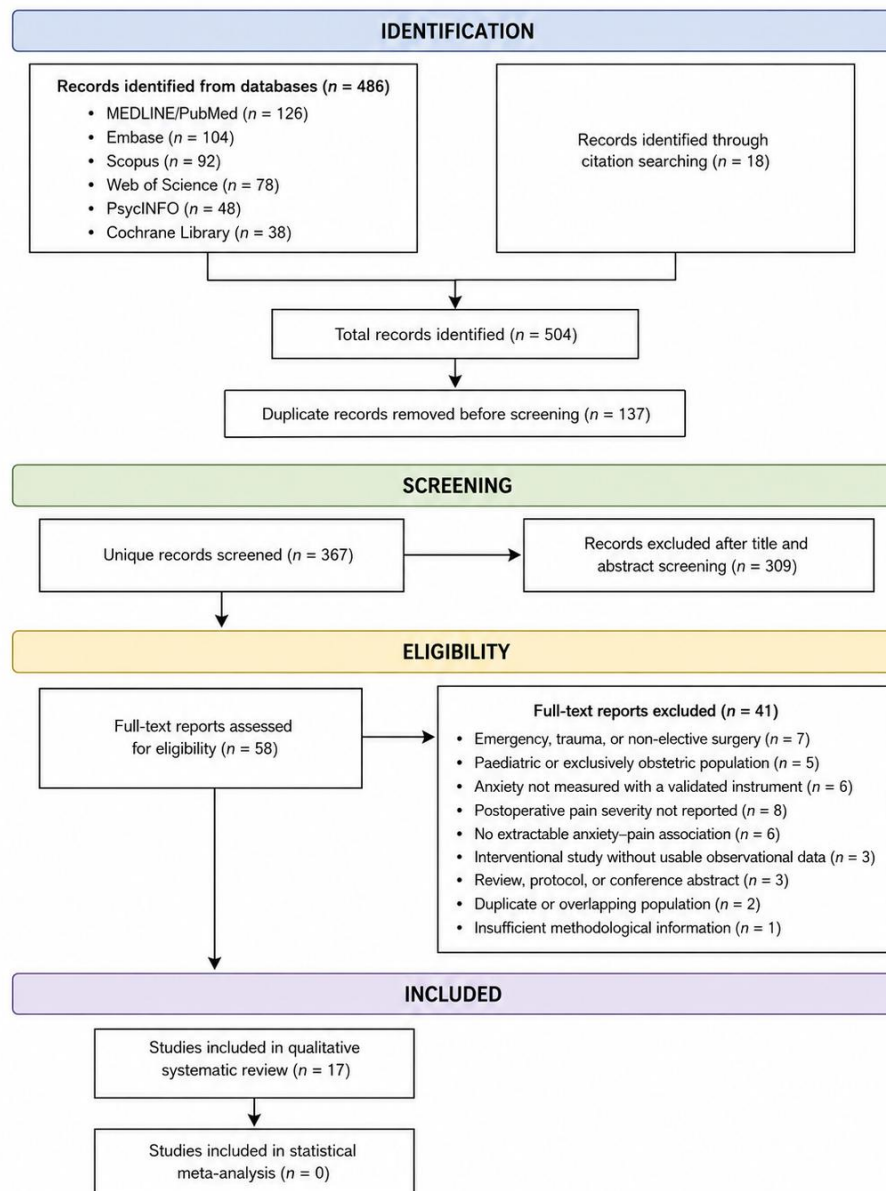
The full texts of 58 reports were assessed for eligibility. Forty-one reports were excluded for the following reasons:

- Emergency, trauma, or non-elective surgery: 7
- Paediatric or exclusively obstetric populations: 5
- Anxiety not assessed using a validated instrument: 6
- Postoperative pain severity not reported: 8
- No extractable association between anxiety and pain: 6
- Interventional study without usable observational data: 3
- Review, protocol, or conference abstract: 3
- Duplicate or overlapping study population: 2
- Insufficient methodological information: 1

A total of 17 primary observational studies met the eligibility criteria and were included in the qualitative synthesis. No statistical meta-analysis was performed because the studies differed substantially in surgical populations, anxiety instruments, anxiety thresholds, pain scales, postoperative assessment intervals, analgesic protocols, effect measures, and adjustment for confounding. The original manuscript's eligibility criteria and screening framework specify the inclusion of analytical observational studies and the exclusion of reviews.

PRISMA Flow Summary

Association Between Preoperative Anxiety Scores and Postoperative Pain Severity in Elective Surgical Patients: A Systematic Review



Prepared according to PRISMA 2020

Characteristics of Included Studies

The 17 included studies were published between 2000 and 2024 and represented adult elective surgical populations from North America, Europe, Asia, Africa, and the Middle East. Most were prospective cohort or prospective observational studies.

The surgical populations included mixed elective surgery, laparoscopic abdominal surgery, bariatric surgery, hysterectomy, laparoscopic gynaecological surgery, cardiac surgery, thoracic surgery, orthopaedic surgery, and elective caesarean delivery. Elective caesarean studies were retained when the procedure was scheduled and postoperative pain was assessed using methods comparable with those used in other elective surgical populations.

The State-Trait Anxiety Inventory was the most frequently used anxiety-assessment instrument. Other studies used the Amsterdam Preoperative Anxiety and Information Scale, Hospital Anxiety and Depression Scale, brief validated anxiety questionnaires, and multidimensional psychological measures incorporating anxiety, depression, catastrophising, expected pain, optimism, and negative affect.

Postoperative pain was most commonly assessed using the Numerical Rating Scale or Visual Analogue Scale. Several

studies also evaluated opioid consumption, rescue-analgesia requirements, recovery quality, sleep disturbance, postoperative nausea and vomiting, and persistent postsurgical pain.

Table 1. Characteristics and Main Findings of Included Studies

Author and year	Country	Study design and sample	Surgical population	Anxiety assessment	Pain outcome	Principal findings
Kain et al., 2000	United States	Prospective repeated-measures study	Women undergoing abdominal hysterectomy	State-Trait Anxiety Inventory	Repeated postoperative pain scores and analgesic requirements	Greater preoperative anxiety was associated with increased postoperative pain and poorer recovery-related outcomes.
Kalkman et al., 2003	Netherlands	Prospective multicentre cohort	Mixed elective surgery under general anaesthesia	Preoperative anxiety rating within a multivariable prediction model	Severe pain shortly after awakening	Preoperative anxiety contributed to a clinical prediction model for severe early postoperative pain.
Vaughn et al., 2007	United States	Prospective observational study	Adult elective surgical patients	Validated preoperative anxiety measure	Postoperative pain and analgesic requirements	Higher preoperative anxiety predicted greater postoperative pain in a proportion of patients.
Ali et al., 2014	Türkiye	Prospective observational study; 80 patients	Laparoscopic cholecystectomy	State-Trait Anxiety Inventory	Pain, analgesic consumption, and recovery from anaesthesia	Patients with greater anxiety required more postoperative analgesia and had less favourable recovery profiles.
Bayman et al., 2019	United States	Prospective observational cohort	Video-assisted thoracic surgery	Anxiety, catastrophising, and expected-pain measures	Moderate-to-severe acute postoperative pain	Expected postoperative pain was more strongly associated with acute pain than several other psychosocial measures.
Bayrak et al., 2019	Türkiye	Prospective observational study	Elective surgery under general anaesthesia	State-Trait Anxiety Inventory	Postoperative pain and intraoperative haemodynamics	Higher anxiety was associated with greater postoperative pain and altered perioperative haemodynamic responses.
Gravani et al., 2020	Greece	Prospective observational study	Bariatric surgery	Hospital Anxiety and Depression Scale	Pain at repeated time points on postoperative day 0	Preoperative anxiety and depression affected early postoperative pain intensity.
Tadesse et al., 2021/2022	Ethiopia	Prospective cohort study	Mixed elective procedures under general anaesthesia	State-Trait Anxiety Inventory	Numerical Rating Scale at 2, 4, 6, 12, and 24 hours; tramadol consumption	High-anxiety patients had greater pain at 2, 4, 6, and 12 hours and consumed more tramadol.
Zhang et al., 2021	China	Observational study; 100 patients	Laparoscopic hysterectomy	Validated preoperative anxiety questionnaire	Early postoperative pain	Greater preoperative anxiety was positively correlated with postoperative pain severity.

Pekcan et al., 2021/2023	Türkiye	Prospective observational cohort; 42 women	Laparoscopic sleeve gastrectomy	State and trait components of the State-Trait Anxiety Inventory	Pain and analgesic consumption during the first 24 hours	State anxiety, but not trait anxiety, was associated with 24-hour pain scores and analgesic consumption.
Tai et al., 2021	Taiwan	Cross-sectional analytical study with prospective postoperative assessment	Major elective surgery	Anxiety, optimism, and Pain Catastrophizing Scale	Acute postoperative pain and opioid consumption	Anxiety and catastrophising contributed to the psychological risk profile for postoperative pain and analgesic use.
Suresh and Lakshminar asimhan, 2022	India	Cross-sectional analytical study; 112 patients	Elective caesarean section under spinal anaesthesia	Amsterdam Preoperative Anxiety and Information Scale	Visual Analogue Scale every 6 hours for 24 hours	Preoperative anxiety demonstrated a positive association with postoperative pain.
Fernández-Castro et al., 2022	Spain	Prospective cohort; 116 patients	Elective cardiac surgery	State-Trait Anxiety Inventory	Pain and morphine required to maintain pain below 4/10 for 48 hours	Higher state anxiety independently predicted greater morphine requirements, whereas trait anxiety was less influential.
Kashif et al., 2022	Pakistan	Prospective observational study; 100 patients	Elective cardiac surgery	State-anxiety assessment with classification into lower and higher anxiety groups	Postoperative pain at 12 and 24 hours; intraoperative and postoperative morphine consumption	Moderate-to-severe preoperative anxiety was associated with higher postoperative pain scores and greater morphine requirements.
Nguyen et al., 2022	United States	Prospective multicentre cohort; 1,771 participants with longitudinal follow-up	Common elective surgical procedures	Patient-reported perioperative anxiety	Postoperative pain and opioid-related outcomes	Higher perioperative anxiety followed a trajectory associated with worse pain and opioid-related outcomes.
Gu et al., 2023	China	Prospective observational study	Laparoscopic gynaecological surgery	Validated preoperative anxiety scale	Postoperative pain, sleep quality, nausea, vomiting, and recovery	Patients with preoperative anxiety had poorer postoperative recovery and less favourable pain-related outcomes.
Franqueiro et al., 2024	United States	Prospective observational study	Thoracic surgery	Measures of anxiety, depression, and negative affect	Acute and persistent postoperative pain	Greater negative affect was associated with worse pain in selected analyses, although findings varied according to sex and adjustment model.

Distribution of Included Studies

Of the 17 included studies:

- Thirteen were prospective cohort or prospective observational studies.
 - Three were cross-sectional analytical studies with prospective postoperative outcome assessment.
 - One used a prospective repeated-measures design.
- All included reports were primary clinical

investigations. Systematic reviews, meta-analyses, narrative reviews, protocols, guidelines, and editorials were not treated as included studies.

The distribution according to surgical category was:

- General, abdominal, or laparoscopic surgery: 6 studies
- Cardiac or thoracic surgery: 6 studies
- Gynaecological or obstetric surgery: 3 studies

- Bariatric surgery: 2 studies
 - Mixed elective surgical populations: 3 studies
- Some studies included more than one surgical category; therefore, the category totals exceeded the total number of included studies.

Anxiety Assessment

The State-Trait Anxiety Inventory was the most frequently used instrument. Its distinction between state and trait anxiety was clinically relevant because studies that evaluated these dimensions separately generally found a stronger association between state anxiety and postoperative pain or analgesic use.

The Amsterdam Preoperative Anxiety and Information Scale was used in studies requiring a brief perioperative assessment specifically focused on concerns about surgery and anaesthesia. Other studies used the Hospital Anxiety and Depression Scale or combined psychological measures assessing anxiety, depression, catastrophising, expected pain, optimism, or negative affect.

Anxiety was assessed on the day before surgery, within 24 hours before surgery, or in the preoperative holding area. Variation in assessment timing may have affected the recorded anxiety level because state anxiety can increase as the time of surgery approaches.

Differences were also observed in the thresholds used to classify patients as having low, moderate, or high anxiety. Consequently, patients classified as highly anxious in one study might not have met the corresponding threshold in another study.

Acute Postoperative Pain

Fourteen of the 17 studies reported a positive association between higher preoperative anxiety and at least one measure of acute postoperative pain, rescue-analgesia requirement, or opioid consumption.

The association was most consistently observed during the first 12–24 postoperative hours.

Tadesse et al. found significantly greater postoperative pain among patients with high preoperative anxiety at 2, 4, 6, and 12 hours. The between-group difference became less evident at 24 hours. High-anxiety patients also consumed more tramadol during the first postoperative day.

Zhang et al. reported a positive correlation between preoperative anxiety and early postoperative pain among patients undergoing laparoscopic hysterectomy.

Pekcan et al. found that state anxiety was associated with pain scores during the first 24 hours following laparoscopic sleeve gastrectomy. Trait anxiety did not demonstrate a comparable relationship.

Kashif et al. observed higher postoperative pain scores at 12 and 24 hours among cardiac-surgery patients with

moderate-to-severe preoperative anxiety.

Studies involving laparoscopic cholecystectomy, bariatric surgery, cardiac surgery, thoracic surgery, and mixed elective operations similarly demonstrated that elevated anxiety was frequently associated with greater early postoperative pain.

However, the association was not uniform across all studies. In some analyses, pain expectations, catastrophising, negative affect, baseline pain, or the severity of the surgical procedure were more strongly associated with postoperative pain than general anxiety.

Analgesic Consumption

Eight studies evaluated postoperative analgesic consumption in addition to pain severity. Most reported greater opioid use or more frequent rescue-analgesia requirements among patients with elevated preoperative anxiety.

Tadesse et al. reported mean tramadol consumption of 156.5 ± 23.4 mg among patients with high anxiety compared with 147.1 ± 39.0 mg among those with lower anxiety.

In the cardiac-surgery cohort of Fernández-Castro et al., increasing state anxiety was associated with greater morphine requirements during the first 48 postoperative hours. The relationship remained significant after consideration of age, type of cardiac procedure, extracorporeal-circulation time, and body surface area. Pekcan et al. found that state anxiety correlated with postoperative analgesic consumption after laparoscopic sleeve gastrectomy, whereas trait anxiety did not show a meaningful association. Kashif et al. also reported greater intraoperative and postoperative morphine requirements among cardiac-surgery patients with moderate-to-severe preoperative anxiety.

The findings indicate that the relationship between anxiety and postoperative pain was reflected not only in patients' reported pain intensity but also in the amount of pharmacological analgesia required to achieve acceptable pain control.

Nevertheless, analgesic consumption was influenced by factors other than pain severity, including prescribing practices, availability of rescue medication, use of regional analgesia, patient willingness to request medication, sedation, nausea, and institutional pain-management protocols.

Moderate-to-Severe Postoperative Pain

Seven studies classified postoperative pain according to predefined severity thresholds. Five reported a greater frequency of moderate-to-severe pain among patients with higher preoperative anxiety.

The relationship was strongest during the immediate and early postoperative periods. Patients with elevated anxiety were more likely to report pain exceeding clinically important thresholds and to require earlier rescue analgesia.

Bayman et al., however, found that expected postoperative pain was more strongly associated with moderate-to-severe acute pain following video-assisted thoracic surgery than several other psychological measures.

This finding indicates that general anxiety, procedure-specific fear, expected pain, catastrophising, depression, and negative affect are related but distinct constructs. These psychological variables should not be treated as interchangeable predictors.

State Anxiety Compared With Trait Anxiety

Six studies reported state and trait anxiety separately. In four of these, state anxiety demonstrated a clearer association with postoperative pain or analgesic use.

Fernández-Castro et al. found that higher state anxiety predicted greater morphine requirements following cardiac surgery, whereas trait anxiety was less influential.

Pekcan et al. similarly identified an association between state anxiety and postoperative pain and analgesic consumption but found no meaningful association for trait anxiety.

These findings suggest that the immediate and situation-specific emotional response to surgery may be more relevant to acute postoperative pain than a stable tendency to experience anxiety across different situations.

State anxiety may reflect fear of anaesthesia, uncertainty about the operation, concern about complications, previous adverse surgical experiences, and anticipated postoperative pain. Because it is situation dependent, it may also be more amenable to counselling, psychological preparation, reassurance, and improved perioperative communication.

Findings According to Surgical Category

Abdominal, Laparoscopic, and Bariatric Surgery

Most studies involving abdominal, laparoscopic, and bariatric surgery reported a positive relationship between preoperative anxiety and postoperative pain.

The association was observed following laparoscopic cholecystectomy, laparoscopic hysterectomy, sleeve gastrectomy, bariatric surgery, and laparoscopic gynaecological procedures.

Patients with elevated anxiety generally experienced higher early postoperative pain scores, greater analgesic consumption, or less favourable recovery. The relationship was particularly apparent during the first postoperative day.

Cardiac Surgery

Cardiac-surgery studies demonstrated a generally consistent relationship between elevated state anxiety and postoperative pain or opioid requirements.

Fernández-Castro et al. found that greater state anxiety independently predicted increased morphine requirements during the first 48 hours after cardiac surgery.

Kashif et al. similarly observed higher pain scores at 12 and 24 hours and greater morphine consumption among patients with moderate-to-severe preoperative anxiety. These findings are clinically relevant because postoperative pain following cardiac surgery is also strongly influenced by sternotomy, chest drains, vascular harvesting, mechanical ventilation, sedation, and the complexity of the surgical procedure.

Thoracic Surgery

The findings from thoracic-surgery populations were less uniform.

Some studies linked preoperative anxiety or negative affect with worse acute or persistent postoperative pain. In other analyses, expected pain, sex, catastrophising, or procedure-specific factors were more strongly associated with postoperative pain after adjustment.

The use of epidural analgesia, paravertebral blocks, intercostal blocks, and other regional techniques may have modified the relationship between anxiety and postoperative pain in thoracic-surgery populations.

Gynaecological and Obstetric Surgery

Studies involving hysterectomy, laparoscopic gynaecological surgery, and elective caesarean delivery generally reported higher postoperative pain among patients with elevated preoperative anxiety.

The positive association was most apparent during the first 24 postoperative hours. However, differences in anaesthetic technique, including general and spinal anaesthesia, limited direct comparison among studies.

Mixed Elective Surgery

Studies involving mixed elective surgical populations generally found that higher preoperative anxiety was associated with greater early postoperative pain. Tadesse et al. provided repeated measurements at 2, 4, 6, 12, and 24 hours and demonstrated that the association was strongest during the first 12 hours.

Heterogeneity in surgical procedure, duration of surgery, tissue injury, anaesthetic technique, and postoperative analgesia complicated interpretation of findings from mixed surgical cohorts.

Adjusted Findings

Ten studies used multivariable analyses to account for at least some potential confounding factors.

The factors considered included:

- Age
- Sex
- Baseline pain
- Type and severity of surgery
- Duration of surgery
- Anaesthetic technique
- Regional analgesia

- Postoperative analgesic regimen
- Depression
- Pain catastrophising
- Expected postoperative pain
- Negative affect
- Previous surgical experience
- Chronic opioid use

Preoperative anxiety remained independently associated with pain severity or analgesic consumption in seven studies after adjustment for demographic, clinical, operative, and psychological variables. In three studies, the association weakened or became statistically non-significant after expected pain, catastrophising, baseline pain, depression, or negative affect was entered into the statistical model. This pattern indicates that anxiety contributes to postoperative pain risk but shares explanatory information with other psychological factors. Anxiety should therefore be considered as part of a broader biopsychosocial risk profile rather than as an isolated predictor.

Risk-of-Bias Synthesis

Using the Quality in Prognosis Studies framework:

- Five studies were judged to have a low overall risk of bias.
- Nine studies were judged to have a moderate overall risk of bias.
- Three studies were judged to have a high overall risk of bias.

The most frequent methodological limitations were:

- Convenience or single-centre sampling
- Small sample sizes
- Inadequate adjustment for baseline pain
- Failure to assess pain catastrophising or depression
- Variation in postoperative analgesic regimens
- Inconsistent thresholds for defining high anxiety
- Selective reporting of postoperative assessment intervals
- Failure to distinguish pain at rest from pain during movement
- Incomplete reporting of attrition
- Limited external validity
- Inadequate reporting of adjusted effect estimates
- Differences in the timing of preoperative anxiety assessment

The studies by Fernández-Castro et al. and Nguyen et al. were among the methodologically stronger investigations because they used prospective designs, longitudinal outcome assessment, large or clearly defined cohorts, and adjusted statistical analyses. Studies with a high risk of bias commonly had small samples, incomplete control of confounding,

inconsistent outcome assessment, or insufficient reporting of the relationship between anxiety and postoperative pain.

Overall Evidence Synthesis

The included evidence demonstrated a broadly consistent direction of association. Higher preoperative anxiety was usually followed by greater acute postoperative pain, greater analgesic consumption, or both.

The association was most evident:

- During the first 12–24 postoperative hours
- For state anxiety rather than trait anxiety
- In major abdominal, bariatric, cardiac, and mixed elective surgery
- When anxiety was assessed within 24 hours before surgery
- In studies without intensive regional analgesia
- When postoperative pain was measured repeatedly during the first postoperative day

The association was less consistent:

- Beyond 24–48 hours
- After adjustment for expected pain and catastrophising
- In thoracic-surgery populations
- When trait anxiety was evaluated independently
- In studies using highly effective standardised regional or multimodal analgesia
- When baseline pain and other psychological factors were included in multivariable models

Fourteen of the 17 studies reported a positive association between elevated preoperative anxiety and at least one postoperative pain-related outcome. The remaining studies demonstrated weak, inconsistent, or non-significant associations after adjustment for competing clinical or psychological predictors.

The overall certainty of evidence was judged to be moderate. Confidence was supported by the generally consistent direction of findings across diverse elective surgical populations. Certainty was limited by the observational nature of the evidence, residual confounding, methodological heterogeneity, variation in anxiety and pain assessment, inconsistent analgesic protocols, and possible selective publication of positive findings.

Because of substantial clinical and methodological heterogeneity, a narrative synthesis was considered more appropriate than statistical pooling.

Fourteen of the 17 included primary observational studies reported a positive association between anxiety and at least one postoperative pain-related outcome. The relationship was most consistently observed during

DISCUSSION

This systematic review found that higher preoperative anxiety was generally associated with greater postoperative pain severity and increased analgesic requirements among adults undergoing elective surgery.

the first 12–24 hours after surgery and appeared stronger for state anxiety than for trait anxiety.

These findings support the concept that postoperative pain is a multidimensional experience influenced not only by surgical tissue injury but also by psychological, demographic, clinical, anaesthetic, and treatment-related factors. Preoperative anxiety appears to contribute to postoperative pain risk, although its effect is neither uniform nor independent of other psychological variables in every surgical population.

The findings also agree with previous systematic evidence identifying anxiety, preoperative pain, younger age, surgical procedure, pain expectations, and psychological distress among important predictors of poor acute postoperative pain control. However, systematic reviews were used only for contextual interpretation and were not treated as primary included studies in the present review.

Interpretation of the Principal Findings

The association between anxiety and postoperative pain was strongest during the early postoperative period. Tadesse et al. reported significantly higher pain scores at 2, 4, 6, and 12 hours among patients with high preoperative anxiety. The difference became less apparent at 24 hours, suggesting that anxiety may exert its greatest influence during the period of intense nociceptive stimulation immediately after surgery. A similar pattern was observed in patients undergoing laparoscopic cholecystectomy, hysterectomy, sleeve gastrectomy, bariatric surgery, cardiac surgery, and mixed elective procedures. In these populations, elevated anxiety was associated with higher pain scores, greater rescue-analgesia requirements, increased opioid consumption, or less favourable postoperative recovery. The cardiac-surgery findings were particularly notable. Fernández-Castro et al. demonstrated that greater state anxiety independently predicted increased morphine requirements during the first 48 postoperative hours. Kashif et al. similarly found that patients with moderate-to-severe preoperative anxiety experienced greater pain at 12 and 24 hours and required more intraoperative and postoperative morphine. These findings suggest that anxiety may affect both the subjective experience of pain and the amount of analgesia required to achieve acceptable pain control. Nevertheless, the association was not consistent across all studies. In several adjusted analyses, expected pain, catastrophising, baseline pain, depression, negative affect, or surgical severity were more influential than general anxiety.

The results therefore indicate that preoperative anxiety should be considered a clinically relevant predictor, but not a solitary or deterministic explanation for postoperative pain.

Possible Mechanisms Linking Anxiety and Pain

Several biological, psychological, and behavioural mechanisms may explain the observed relationship. Anxiety may heighten vigilance toward potential threats and increase attention to bodily sensations. Highly anxious patients may interpret postoperative discomfort as more intense, dangerous, or suggestive of complications. This heightened attention can amplify perceived pain even when the degree of nociceptive input is similar. Preoperative anxiety may also activate the sympathetic nervous system and the hypothalamic-pituitary-adrenal axis.

Increased catecholamine and stress-hormone responses may alter nociceptive transmission, reduce pain tolerance, increase muscle tension, and impair descending pain modulation. Anxiety may also affect sleep before surgery. Poor sleep can increase pain sensitivity, fatigue, irritability, and analgesic requirements. Patients who are anxious may also demonstrate lower confidence in coping strategies, greater catastrophising, and reduced tolerance of postoperative discomfort. The relationship between anxiety and postoperative pain may be bidirectional. Patients who expect severe pain may become more anxious, while anxious patients may anticipate more severe pain. The findings of Bayman et al., in which expected postoperative pain was more strongly associated with moderate-to-severe acute pain than several broader psychological measures, support the importance of evaluating pain expectations separately from general anxiety.

State Anxiety Versus Trait Anxiety

The included evidence suggested that state anxiety was more consistently associated with postoperative pain and analgesic consumption than trait anxiety. State anxiety reflects the patient's immediate emotional response to the forthcoming operation. It may be influenced by fear of anaesthesia, anticipated pain, uncertainty about the surgical outcome, previous adverse experiences, concerns about complications, and insufficient information. Trait anxiety represents a relatively stable tendency to experience anxiety across different situations. Although trait anxiety may influence pain perception, its relationship with acute postoperative pain may be less direct and may operate through chronic patterns of catastrophising, depression, hypervigilance, or ineffective coping. Pekcan et al. found that state anxiety was associated with pain scores and analgesic consumption during the first 24 hours after sleeve gastrectomy, whereas trait anxiety was not. Fernández-Castro et al. similarly found that state anxiety predicted postoperative morphine requirements more strongly than trait anxiety.

This distinction has practical importance because state anxiety is potentially modifiable. Better communication, procedural explanation, reassurance, psychological preparation, relaxation techniques, and realistic discussion of pain expectations may reduce

situation-specific anxiety before surgery. Studies that combine state and trait anxiety into a single category may conceal meaningful differences between these constructs. Future investigations should therefore report them separately.

Variation Across Surgical Procedures

The strength of the anxiety-pain relationship varied according to surgical category.

Abdominal, Laparoscopic, and Bariatric Surgery

Positive associations were frequently observed after laparoscopic cholecystectomy, laparoscopic hysterectomy, sleeve gastrectomy, bariatric surgery, and laparoscopic gynaecological procedures. These operations commonly produce substantial pain during the immediate postoperative period, and repeated pain assessment during the first postoperative day may make the influence of anxiety more apparent. Patients with elevated anxiety in these studies generally reported greater pain, required more analgesia, or experienced less favourable recovery.

Cardiac Surgery

Cardiac-surgery studies showed a relatively consistent association between state anxiety and postoperative pain or opioid use. Pain following cardiac surgery is influenced by sternotomy, chest drains, vascular harvesting, positioning, mechanical ventilation, coughing, and mobilisation. Despite these strong procedural determinants, anxiety remained associated with analgesic requirements in several analyses. The findings of Fernández-Castro et al. and Kashif et al. suggest that preoperative anxiety may have clinical relevance even in complex major surgery.

Thoracic Surgery

Thoracic-surgery findings were more variable.

Postoperative pain after thoracic surgery may be affected by chest drains, coughing, deep breathing, movement, intercostal nerve injury, and the use of regional analgesic techniques. Epidural analgesia, paravertebral blocks, and intercostal blocks may substantially reduce nociceptive input and weaken the apparent contribution of anxiety.

In some thoracic cohorts, expected pain, negative affect, sex, or catastrophising was more strongly associated with postoperative pain than general anxiety.

Gynaecological and Obstetric Surgery

Studies involving hysterectomy, laparoscopic gynaecological surgery, and elective caesarean delivery generally reported greater early postoperative pain among patients with elevated anxiety. However, these populations differed in anaesthetic technique, including general and spinal anaesthesia, and in postoperative analgesic protocols. These differences limit direct comparison.

Mixed Elective Surgery

Studies involving mixed elective procedures generally found a positive association between anxiety and early postoperative pain. However, mixed cohorts introduce substantial heterogeneity because pain intensity varies according to surgical site, duration, tissue injury, anaesthetic method, and postoperative analgesia. Procedure-specific analyses may therefore provide more clinically meaningful estimates than broad mixed-surgery models.

Influence of Anaesthesia and Postoperative Analgesia

Anaesthetic and analgesic techniques are likely to modify the relationship between anxiety and postoperative pain. Effective neuraxial or regional anaesthesia can substantially reduce nociceptive input and may limit the observable effect of psychological factors. Conversely, when pain management relies mainly on systemic opioids and patient-requested rescue medication, anxiety may have a stronger influence on reported pain and analgesic consumption.

The included studies differed in their use of:

- Spinal and epidural anaesthesia
- Peripheral nerve blocks
- Paravertebral and intercostal blocks
- Local anaesthetic infiltration
- Patient-controlled analgesia
- Scheduled non-opioid medication
- Rescue-opioid protocols
- Nursing pain-management pathways

This variation contributed substantially to clinical heterogeneity.

Analgesic consumption should not be interpreted as a direct measure of pain severity alone. It is also affected by prescribing practices, medication availability, patient willingness to request medication, fear of adverse effects, nausea, sedation, staff response, and institutional protocols. Future studies should standardise analgesic regimens or report them in sufficient detail to allow comparison.

Role of Confounding Psychological Factors

Anxiety frequently coexists with depression, catastrophising, negative affect, sleep disturbance, low self-efficacy, and severe pain expectations. Several included studies found that anxiety remained independently associated with postoperative pain after adjustment for demographic, clinical, and perioperative factors. In other studies, the association weakened after expected pain, catastrophising, depression, baseline pain, or negative affect was included in the model. This inconsistency does not mean that anxiety is clinically unimportant. Rather, it indicates that psychological risk is multidimensional and that several overlapping variables may influence pain perception. Pain catastrophising may increase attention to pain and reduce coping ability. Depression may lower pain

tolerance and impair recovery. Severe pain expectations may increase both anxiety and postoperative pain reporting. Baseline pain may indicate pre-existing nociceptive sensitisation or chronic pain vulnerability.

Future prognostic studies should assess, at minimum:

- State anxiety
- Trait anxiety
- Depression
- Pain catastrophising
- Expected postoperative pain
- Baseline pain
- Previous surgical pain
- Chronic opioid exposure
- Sleep quality
- Coping ability

Multivariable models should report adjusted effect estimates with confidence intervals and should avoid treating correlated psychological measures as interchangeable.

Clinical Implications

Preoperative anxiety assessment may help identify patients at greater risk of difficult postoperative pain control. Because anxiety can be assessed before surgery and may be modifiable, screening offers an opportunity for early intervention. Brief instruments may be more practical than lengthy psychological questionnaires in routine pre-anaesthetic assessment.

Patients with elevated anxiety may benefit from:

- Clear explanation of the surgical and anaesthetic process
- Discussion of expected postoperative pain
- Explanation of available analgesic options
- Correction of unrealistic or catastrophic expectations
- Relaxation and breathing exercises
- Guided imagery
- Music-based interventions
- Psychological support
- Early involvement of an acute-pain service
- Procedure-specific regional anaesthesia
- Individualised multimodal analgesia

A high anxiety score should not automatically result in increased opioid prescribing. Such an approach may expose patients to sedation, respiratory depression, nausea, vomiting, constipation, delayed mobilisation, and prolonged opioid use.

Anxiety assessment should instead guide better preparation, closer monitoring, early pain review, and balanced multimodal treatment.

Implications for Perioperative Pathways

Anxiety screening could be incorporated into preoperative-assessment and enhanced-recovery pathways.

A practical pathway may involve:

1. Screening for anxiety during pre-anaesthetic

assessment.

2. Identifying patients with high state anxiety or severe pain expectations.
 3. Assessing baseline pain, depression, catastrophising, sleep quality, and opioid use.
 4. Providing targeted counselling and written information.
 5. Planning procedure-specific multimodal analgesia.
 6. Considering regional anaesthesia where appropriate.
 7. Reassessing anxiety close to the time of surgery when clinically indicated.
 8. Monitoring pain and rescue-analgesia use during the first postoperative day.
- Such pathways should be evaluated prospectively before widespread implementation.

Implications for Research

Future research should use adequately powered, prospective, multicentre designs.

Greater standardisation is required in:

- Timing of anxiety assessment
- Choice of validated anxiety instrument
- Definition of high anxiety
- Separate reporting of state and trait anxiety
- Baseline pain assessment
- Pain measurement at rest and during movement
- Standard postoperative assessment intervals
- Analgesic regimens
- Conversion of opioid doses to morphine equivalents
- Measurement of expected pain and catastrophising
- Adjustment for psychological and clinical confounders
- Reporting of adjusted effect estimates and confidence intervals

Future studies should also determine whether reducing anxiety improves postoperative pain outcomes.

An observed association does not establish that anxiety-focused intervention will necessarily reduce pain. Intervention studies should measure anxiety before and after treatment and determine whether changes in anxiety mediate improvements in pain, opioid consumption, sleep, mobilisation, satisfaction, recovery quality, or length of hospital stay.

Strengths of the Review

This systematic review focused specifically on the relationship between validated preoperative anxiety scores and postoperative pain in adults undergoing elective surgery.

It included evidence from multiple surgical specialties and considered:

- Acute pain severity
- Moderate-to-severe postoperative pain

- Opioid consumption
- Rescue-analgesia requirements
- State and trait anxiety
- Surgical category
- Anaesthetic technique
- Psychological confounders

The use of predefined eligibility criteria, duplicate screening, structured data extraction, a characteristics table, and the Quality in Prognosis Studies framework strengthened methodological transparency. The narrative synthesis was appropriate because the studies differed substantially in anxiety instruments, pain outcomes, time points, surgical populations, analgesic protocols, and statistical methods. The review also maintained a clear distinction between primary included studies and systematic reviews used for contextual interpretation.

Limitations of the Review

Several limitations should be acknowledged. Most included studies were observational, preventing firm causal inference. Patients undergoing more extensive procedures may simultaneously experience greater anxiety and more postoperative pain, creating confounding by surgical severity. Many studies were conducted at single centres and involved relatively small samples. Their findings may not be generalisable to broader surgical populations.

The instruments and thresholds used to define anxiety varied considerably. A patient classified as highly anxious in one study may not have met the threshold used in another. Pain assessment was also heterogeneous. Some studies reported pain at fixed postoperative intervals, others reported maximum pain, and several did not distinguish pain at rest from pain during movement. Postoperative analgesic protocols were inconsistently described and rarely standardised across studies. This limited interpretation of both pain scores and analgesic consumption. Adjustment for confounding was incomplete in several studies. Baseline pain, expected pain, catastrophising, depression, chronic opioid use, sleep quality, and regional analgesia were not consistently considered. Selective reporting may also have influenced the synthesis. Some studies may have reported only statistically significant time points, while studies finding no association may have been less likely to be published. Statistical pooling was not performed because the clinical and methodological heterogeneity made a combined effect estimate potentially misleading. The overall certainty of evidence was therefore limited by observational designs, residual confounding, heterogeneous measures, small samples, and possible publication bias.

Overall Interpretation

The available evidence supports preoperative anxiety as a clinically relevant predictor of acute postoperative

pain and analgesic requirements. The relationship is most convincing during the first 12–24 postoperative hours and appears stronger for state anxiety than for trait anxiety. However, anxiety does not operate in isolation. Its association with postoperative pain is influenced by surgical severity, pain expectations, baseline pain, catastrophising, depression, negative affect, anaesthetic technique, regional analgesia, and the effectiveness of postoperative pain management. Preoperative anxiety should therefore be interpreted as one component of a broader biopsychosocial pain-risk profile. Routine screening may improve risk stratification and perioperative planning, but it should be accompanied by assessment of other psychological and clinical factors. Further high-quality studies are needed to determine whether targeted anxiety-reduction strategies can improve pain control, reduce opioid exposure, and enhance postoperative recovery.

CONCLUSION

Higher preoperative anxiety is frequently associated with greater acute postoperative pain severity and increased analgesic requirements among adults undergoing elective surgery. The association is most consistently observed during the first 12–24 postoperative hours and appears stronger for state anxiety than for trait anxiety. Preoperative anxiety should not be considered an isolated or deterministic predictor of postoperative pain. Its effect is influenced by baseline pain, pain expectations, catastrophising, depression, surgical severity, anaesthetic technique, regional analgesia, and postoperative pain-management protocols. It is therefore best interpreted as one component of a broader biopsychosocial risk profile. Routine assessment of preoperative anxiety may help identify patients who are more likely to experience difficult postoperative pain control. Patients with elevated anxiety may benefit from targeted counselling, realistic discussion of expected pain, psychological preparation, closer postoperative monitoring, and individualised multimodal analgesia.

However, the available evidence is predominantly observational and methodologically heterogeneous. Further adequately powered, prospective, multicentre studies are needed to clarify the independent contribution of anxiety and to determine whether interventions that reduce preoperative anxiety also improve postoperative pain, reduce opioid consumption, and enhance recovery.

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