



Advancing perioperative care: introducing patient-centered comfort management

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Abstract: The perioperative patient-centered comfort management (2P2CM) model introduces a transformative approach to surgical care, prioritizing patient comfort, psychological well-being, and satisfaction across the perioperative continuum. Unlike traditional models that focus primarily on clinical outcomes, the 2P2CM model emphasizes a holistic framework that integrates preoperative, intraoperative, and postoperative interventions tailored to individual patient needs. This review synthesizes the emerging evidence supporting the 2P2CM model, which aims to alleviate preoperative anxiety, optimize postoperative pain management, and tailor care to individual patient needs. The model integrates contributions from multiple disciplines, leveraging multimodal analgesia, personalized pain management strategies, and nonpharmacological interventions to enhance patient outcomes and reduce reliance on opioids. A key strength of the 2P2CM model lies in its interdisciplinary approach, incorporating insights from anesthesiology, nursing, psychology, and physical therapy to enhance recovery and minimize opioid dependence. By emphasizing shared decision-making and patient-reported outcomes, the 2P2CM model addresses the holistic needs of surgical patients, from preoperative anxiety to postoperative recovery. The review highlights the potential of this model to improve patient satisfaction, reduce postoperative complications, and establish a new standard for patient-centered perioperative care. Future research is necessary to further refine the components of the 2P2CM model and assess its long-term efficacy across a variety of surgical contexts.

Keywords: Perioperative care; patient-centered comfort management; multimodal analgesia; patient-reported outcomes

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Introduction

Traditionally, perioperative care has been segmented, with a focus on distinct phases such as preoperative preparation, intraoperative management, and postoperative recovery. Despite being effective in addressing immediate needs, this fragmented approach often falls short in providing a cohesive and patient-centered experience. Inconsistencies in care can lead to variable patient outcomes, increased complication risks, and suboptimal use of healthcare resources. In response, a more holistic and integrated model of care, one that we refer to as perioperative patient-centered comfort management (2P2CM), is gaining momentum. This concept, outlined in the review that follows, emphasizes a patient-centered approach for optimizing the surgical experience in its entirety.

While patient-centered models are well-established in pediatrics (e.g., tailored preoperative play therapy), adult perioperative care lags due to systemic fragmentation and resource limitations. The 2P2CM model adapts pediatric successes to adult contexts by standardizing comfort metrics and decentralizing decision-making to multidisciplinary teams. For providing coordinated care, the 2P2CM model incorporates a multidisciplinary team that focuses on open communication, shared decision-making, and the seamless coordination of care to address each patient's unique needs. By doing so, it seeks to reduce postoperative complications, shorten hospital stays, and enhance patient satisfaction. However, the implementation of 2P2CM requires a delicate balance between achieving effective analgesia and minimizing the potential risks associated with sedative medications, such as delirium and respiratory depression. There is also a need for a nuanced approach to medication management that accounts for the impact of sedation depth on patient outcomes.

We conducted a review of the relevant literature to clarify the emerging concept of 2P2CM and to examine the evidence bases for various pain and anxiety management strategies. This review discusses the role of multimodal analgesia, the implications of pharmacogenomics in personalized pain management, and the potential benefits of nonpharmacological interventions. Additionally, it highlights the importance of patient-reported outcomes in tailoring care to individual patient needs and the role of

enhanced recovery pathways in improving postoperative outcomes.

Challenges in perioperative care: pre- and postoperation

The spectrum of perioperative care is fraught with challenges that span from preoperative anxiety to postoperative pain and cognitive dysfunction (1). Preoperative anxiety, affecting an alarming 11% to 80% of patients worldwide (2,3), is a complex phenomenon influenced by a myriad of factors including cultural background, type of surgery, environmental influences, and the support from family and healthcare teams. In China, the rate of preoperative anxiety is notably higher at 25.9% (4), but the actual figures could be significantly greater given the cultural norms of restraint and the underreporting of anxiety (5,6).

The implications of untreated preoperative anxiety are far-reaching and can potentially lead to increased postoperative pain, prolonged hospital stays, and a heightened risk of chronic postsurgical pain (7). Postoperative pain, especially following invasive procedures such as open chest or pancreatic surgeries, is inevitable and can have a profound impact on a patient's recovery journey. Chronic persistent postsurgical pain (CPPSP) affects a substantial portion of patients, with studies indicating that 10–30% of patients continue to experience pain long after their incisions have healed (8,9).

Furthermore, postoperative cognitive dysfunction (POCD) is a serious concern, with research showing that approximately 36–41% of patients exhibit cognitive impairment at hospital discharge after major noncardiac surgery, with 5–12% still experiencing these deficits at 3 months postoperation (10). The long-term persistence of POCD, affecting around 1% of patients even a year after surgery, underscores the need for a comprehensive approach to perioperative care that addresses not only physical pain but also cognitive and psychological well-being (11).

By integrating a multidisciplinary approach, the 2P2CM model has the potential to mitigate the effects of preoperative anxiety, more effectively manage postoperative pain, improve patient outcomes, and enhance the recovery experience.

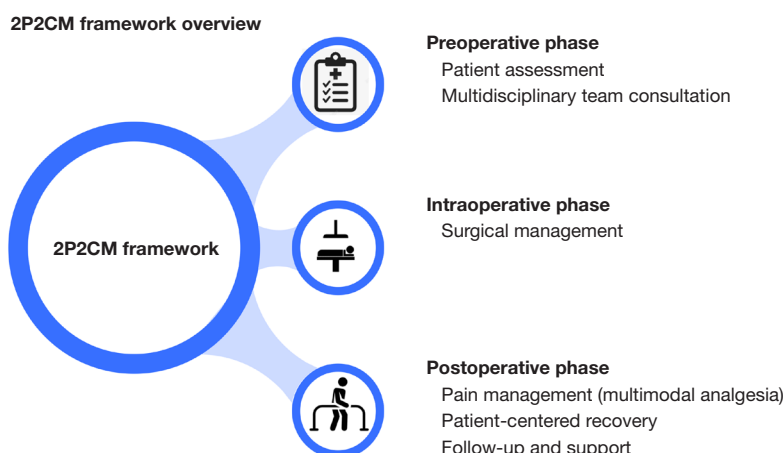


Figure 1 A simplified view of the 2P2CM framework, highlighting the key phases of the perioperative period and the main activities within each phase. The preoperative phase emphasizes patient assessment and multidisciplinary team consultation. The intraoperative phase focuses on surgical management. The postoperative phase includes pain management strategies and patient-centered recovery, emphasizing the importance of follow-up and support. 2P2CM, perioperative patient-centered comfort management.

Perioperative comfort-centered management strategies

Definition and objectives

The 2P2CM strategy is a forward-thinking approach that represents a new era in surgical care, in which the central tenet is the patient's comfort throughout the entire perioperative period. The 2P2CM approach is rooted in a comprehensive care model that integrates various disciplines to provide a continuum of care that is personalized, effective, and focused on the patient's subjective experience of comfort. This strategy transcends the traditional surgical care model by emphasizing a proactive, collaborative approach that involves the patient as an active participant in the care plan (*Figure 1*).

The objectives of 2P2CM are as follows:

- (I) Alleviate preoperative anxiety through the implementation of strategies that reduce the patient's psychological distress before surgery, thus accounting for the impact of anxiety on surgical outcomes and the importance of mental preparedness;
- (II) Effectively manage postoperative pain via a multimodal analgesic approach that minimizes the reliance on opioids, thereby reducing the risk of chronic pain and other opioid-related adverse effects (12);
- (III) Facilitate early recovery by promoting early

mobilization and a speedy return to preoperative functioning, with the aim of shortening hospital stay and enhancing the overall efficiency of the recovery process;

- (IV) Increase patient satisfaction by ensuring that the care provided is attentive to the patient's preferences, expectations, and feedback; and
- (V) Optimize clinical outcomes by improving postoperative recovery via a reduction in complications and improvement of the patient's physical and mental well-being, leading to better long-term health outcomes.

Preoperative assessment and appropriate sedation strategies

A pivotal component of the 2P2CM model is preoperative assessment, which is designed to identify and address potential risks and psychological states that may affect the patient's comfort and recovery. This assessment is crucial for tailoring the sedation strategy to meet the individual needs of each patient, thereby optimizing the balance between ensuring comfort and minimizing the risk of adverse events (13).

The preoperative assessment involves a thorough evaluation of the patient's medical history, including any history of substance abuse, prior experiences with anesthesia, and current medication use. It also encompasses a detailed exploration of the patient's psychological state,

with a focus on identifying signs of anxiety, depression, and any concerns they may have regarding the upcoming surgery. Tools such as the Preoperative Intrusive Thoughts Inventory (PITI) (14), the Amsterdam Preoperative Anxiety and Information Scale (APAIS) (15), visual analogue scale (VAS), and State-Trait Anxiety Inventory (STAI) (16) are used to quantify the level of preoperative anxiety, which has been linked to postoperative outcomes.

The goal of the preoperative assessment is to stratify the patient's risk for postoperative complications, including the development of chronic pain and cognitive dysfunction. By understanding the patient's baseline level of anxiety and their concerns about the surgery, the healthcare team can develop a targeted intervention plan aimed at reducing these risks.

The selection of appropriate sedative medications is a critical aspect of the preoperative phase within the 2P2CM framework. These medications play a vital role in managing patient anxiety and ensuring a smooth transition to surgery. Dexmedetomidine, a highly selective α_2 -adrenergic receptor agonist, is recognized for its sedative and analgesic properties and its potential to reduce delirium and anxiety, making it a valuable option in the preoperative setting (17,18). Pregabalin, a γ -aminobutyric acid (GABA) analog, is extensively used for its analgesic and anxiolytic effects, and its combination with opioids can lead to a reduction in opioid consumption (19-21).

Benzodiazepines, such as lorazepam and midazolam, have been traditionally used for their anxiolytic and sedative effects, which can benefit patient self-reported outcomes in postoperative psychology and pain recovery (22). They are also widely applied in preoperative anxiety management (23). Melatonin, as an alternative to benzodiazepines, has shown promise in improving perioperative anxiety and reducing the incidence of delirium (2,18).

However, the use of benzodiazepines and nonbenzodiazepine receptor agonists ("Z-drugs") has been associated with an increased likelihood of adverse postoperative outcomes, particularly when co-prescribed with opioids (24). Preoperative use of benzodiazepines or sedative or hypnotic drugs may also correlate with an increased prescription of opioids after surgery (25). Therefore, the timing of medication administration, given the pharmacokinetic properties of the drugs, is an essential factor in evaluating the efficacy of preoperative sedation. A Dutch study investigated the use of sedative medications prior to surgery and found that midazolam (62.7%), oxazepam (20.2%), and temazepam (7.8%) were the most

commonly prescribed and usually taken orally an hour before the procedure (26). Despite this routine use, this study did not find there to be a correlation between the use of these medications and reduced anxiety levels in patients. The authors suggested that the pharmacokinetics of these drugs may not align with their intended use for preoperative anxiety, indicating a need for clearer guidelines for their preoperative administration (26,27). The need for clear guidelines on the preoperative use of these medications, given that their pharmacokinetic profiles may not align with their intended use.

Beyond pharmacological interventions, nonpharmacological strategies such as aromatherapy, music therapy, and acupuncture have been reported to be effective in managing preoperative anxiety, although further research is needed to confirm their efficacy (28-30).

The choice of sedative medication for preoperative anxiety management should be based on the type of surgery, patient characteristics, and the expectations of both the patient and the healthcare provider. The related literature does not provide a definitive recommendation for the best medication in specific situations. Therefore, a comprehensive preoperative assessment within the 2P2CM framework has been designed to personalize the patient's experience, ensuring the patient enters the surgical procedure in the best possible psychological state.

Perioperative multimodal analgesia within the 2P2CM framework

Traditional pain management has primarily relied on opioids, which despite their efficacy, involve a number of drawbacks, including respiratory depression, gastrointestinal upset, and the risk of addiction. The 2P2CM model embraces the multimodal analgesia strategy (31,32), leveraging a combination of different analgesics to provide superior pain control, reduce the reliance on opioids, and minimize the associated adverse effects and potential for chronic dependence (33,34).

The multimodal approach often includes a variety of medications and techniques:

Dexmedetomidine, a selective α_2 -adrenergic receptor agonist, has emerged as a valuable asset in perioperative sedation due to its unique properties that strike a balance between anxiolysis and analgesia without causing respiratory depression. Evidence from the MENDS (Maximizing the Efficacy of Sedation and Reducing Neurological Dysfunction and Mortality in Sepsis) trial has demonstrated

that dexmedetomidine can reduce the duration of brain dysfunction and decrease the likelihood of delirium in the days following surgery as compared to lorazepam, a commonly used benzodiazepine (35,36). The SEDCOM (The Safety and Efficacy of Dexmedetomidine Compared with Midazolam) trial further established the benefits of dexmedetomidine by demonstrating a lower incidence of delirium and reduced duration of mechanical ventilation compared to midazolam, another benzodiazepine (37). The DEXCOM study, a recent randomized controlled trial (RCT), highlighted the potential of dexmedetomidine to shorten the duration of delirium following cardiac surgery, although it did not reduce the overall incidence as compared to morphine-based therapy (38).

Ketamine, an N-methyl-D-aspartate (NMDA) receptor antagonist, is known for its ability to alleviate pain through the activation of the monoaminergic descending pain inhibition pathways and by blocking NMDA receptors, which are implicated in the wind-up phenomenon and spinal reflexes that contribute to opioid-induced hyperalgesia (OIH) (39). Research has indicated that the use of ketamine in the perioperative period can lead to a reduction in postoperative analgesic consumption and intensity of pain, especially among patients who have been using opioids prior to surgery (40,41). This effect is particularly beneficial in managing pain for patients who might have developed a tolerance to opioids, thereby requiring higher doses for adequate pain control.

Esmolol, a β -1 receptor antagonist, is not typically recognized for its analgesic or anesthetic properties. However, a recent study has suggested that it may offer anti-hyperalgesic effects and reduce the need for postoperative opioid administration (42). In an RCT involving patients undergoing hysterectomy, the intraoperative use of esmolol led to a significant decrease in the amounts of isoflurane and fentanyl required for anesthesia. Moreover, these patients also experienced a notable reduction in the total morphine consumption within the first 3 days after operation (43). The perioperative use of esmolol as an alternative to opioids has demonstrated potential benefits in reducing the incidence of postoperative nausea and vomiting, which are common side effects associated with opioid use (44).

Other medications including acetaminophen, nonsteroidal anti-inflammatory drugs (NSAIDs), gabapentinoids, tramadol, and lidocaine have been proven to effectively complement opioid analgesia.

Regarding local anesthetic techniques, a study has shown that the perioperative use of liposomal bupivacaine

infiltration in total knee arthroplasty (TKA) reduces opioid usage within the first 24 hours after postoperation. This approach also leads to a decrease in the use of antiemetic drugs and an improvement in postoperative pain scores within the same timeframe, along with significant institutional cost savings (45). Moreover, research indicates that single-wound infiltration with bupivacaine and epinephrine during cesarean sections can effectively reduce postoperative pain and opioid usage, potentially enhancing maternal satisfaction with pain management (46). However, the efficacy of analgesia can be influenced by the site of local anesthetic injection or infiltration (47).

Techniques such as peripheral nerve blocks or wound infiltration provide localized pain relief by blocking pain signals at their origin. For patients with refractory pain, particularly those with advanced pancreatic cancer, more invasive strategies such as celiac plexus block or repeated high-intensity focused ultrasound combined with iodine-125 seed interstitial brachytherapy have shown promise in providing effective pain control and improving quality of life (48-50).

Multimodal analgesia is not a one-size-fits-all approach and requires personalized exploration based on the type of surgery and patient traits. It is important to note that an increase in the number of analgesic modes does not necessarily guarantee superior outcomes. For instance, an RCT on patients subjected to TKA demonstrated that the addition of several analgesic interventions after TKA, such as local anesthetic infiltration, intravenous dexmedetomidine, flurbiprofen, an extra dose of dexamethasone, and repeated femoral nerve blocks, did not significantly reduce opioid consumption or pain scores, nor did it improve functional outcomes (51). This finding indicates that the efficacy of multimodal analgesia may reach a plateau when additional interventions do not confer added benefits. Therefore, the development of a multimodal analgesia plan should involve a careful assessment of the potential benefits and risks of each component, with consideration given to the specific surgical procedure and the patient's unique circumstances.

By being treated with a multimodal analgesia approach, the majority of patients require fewer opioids during their hospital stay, and many require no opioids upon discharge (52). This strategy not only reduces dependence but also accelerates recovery, potentially decreasing postoperative weight loss, maintaining better cardiopulmonary function, reducing complications, and shortening hospital stay (53,54). Thus, the optimal

multimodal plan may vary, and not every additional intervention may enhance outcomes. Tailoring the approach to the specific needs of the patient and procedure is key to maximizing comfort and effectively expediting recovery. Further research is needed to identify the most effective analgesic combinations for different surgical contexts.

Multidisciplinary team coordination and communication

Effective implementation of 2P2CM hinges on cohesive collaboration among a multidisciplinary team. Surgeons, anesthesiologists, nurses, and allied health professionals (e.g., psychologists, physiotherapists) must operate within a unified framework (55). Key strategies include: (I) structured handovers using standardized tools (e.g., SBAR—Situation, Background, Assessment, Recommendation) to ensure continuity of care; (II) daily multidisciplinary rounds to align on patient-specific goals; and (III) digital health platforms for real-time updates on patient-reported outcomes. This integrated approach minimizes communication gaps, reduces errors, and ensures that comfort management strategies are consistently applied across all perioperative phases.

Tailoring comfort-centered management plans with patient-reported outcomes

Beyond traditional objective outcomes such as vital signs, visual analog pain scales, and opioid consumption, incorporating patient-reported outcomes such as pain burden, emotional distress, physical function, and social well-being provides a more comprehensive understanding of a patient's overall experience with pain and treatment (56,57). The Patient-Reported Outcomes Measurement Information System (PROMIS), developed by the National Institutes of Health, is a validated tool designed to effectively capture these patient-reported outcomes (56). Healthcare providers, including nurses, surgeons, anesthesiologists, and pain specialists, can use PROMIS to track patient-reported outcomes that reflect individual experiences and preferences. This system enables clinicians to identify significant physical and psychological risk factors that may predict poor pain outcomes, allowing for the allocation of resources and the development of personalized treatment strategies for high-risk patients (58–60).

By integrating patient-reported outcomes into the 2P2CM framework, a more nuanced and patient-centered approach to postoperative care can be achieved, leading

to improved satisfaction and potentially better health outcomes. The systems such as PROMIS serve as a valuable asset in this endeavor, facilitating a data-driven, individualized approach to comfort-centered management.

Beyond data collection, PROMIS facilitates active patient advocacy. For instance, preoperative education sessions utilize visual aids to explain pain management options, enabling patients to express preferences during multidisciplinary rounds. Postoperatively, mobile apps linked to PROMIS allow real-time symptom reporting, triggering automatic alerts to care teams if thresholds are breached. This dynamic loop ensures patient voices drive individualized adjustments to comfort plans.

The 2P2CM model represents a significant evolution in the approach to surgical care, involving comprehensive and patient-centered strategy that spans the entire perioperative continuum. The 2P2CM model emphasizes the need for a personalized care plan that considers the unique needs and preferences of each patient. By integrating personnel from multiple disciplines and promoting open communication, this model aims to reduce postoperative complications, shorten hospital stays, and improve overall patient satisfaction. The use of evidence-based practices in areas such as multimodal analgesia has been shown to decrease opioid consumption and related adverse effects, contributing to better patient outcomes. Moreover, the consideration of patient-reported outcomes in the 2P2CM framework allows for a more nuanced understanding of the patient's experience, allowing providers to tailor treatments and interventions to individual needs. This approach not only addresses the physical aspects of care but also accounts for the psychological and emotional well-being of patients, which are critical components of a successful recovery.

Although the 2P2CM model presents a promising direction for improving perioperative care, it is not without challenges. Balancing effective analgesia with the potential risks associated with sedative medications requires careful consideration. Additionally, the implementation of this model necessitates a commitment to continuous evaluation and refinement based on emerging evidence and patient feedback. Future research should focus on further optimizing the components of the 2P2CM model, assessing the long-term outcomes of this approach, and identifying strategies to overcome the barriers to implementation. Indeed, the 2P2CM model has the potential to set a new standard for perioperative care, ensuring that patients receive the highest quality of care throughout their surgical journey.

Conclusions

The 2P2CM model embodies a transformative shift toward a more holistic and patient-focused approach to perioperative care. Through the strategic integration of multimodal analgesia, personalized care plans, and patient-reported outcomes, this model aims to enhance patient comfort, facilitate recovery, and improve the overall quality of surgical care. As the field of perioperative medicine continues to advance, the 2P2CM model epitomizes the ethos of a patient-centered, comfort-conscious approach.

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Footnote

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