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NARRATIVE REVIEW

Evidence for yoga, Pranayama and mindfulness-based interventions in perioperative care: a mini review

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ABSTRACT

Yoga, Pranayama and mindfulness-based interventions have gained increasing attention as adjuncts to perioperative care. These mind–body techniques may reduce anxiety and pain, improve pulmonary function, and modulate immune responses, which are critical factors for surgical recovery. A mini review was conducted following Scale for the Assessment of Narrative Review Articles quality criteria, with searches performed in PubMed, ScienceDirect, the Beth Israel Deaconess Medical Center repository, and Google Scholar for studies published between 2016 and 2025. Eligible studies included randomized controlled trials, observational studies, systematic reviews, and meta-analyses involving adult surgical patients. Interventions focused on yoga-based practices, such as Pranayama, and mindfulness-based interventions delivered during the perioperative period. Twenty-one articles were included and thematically analyzed. Evidence showed that short-term preoperative Pranayama reduced intraoperative fentanyl use by approximately 20%, shortened ventilation time, and decreased Intensive Care Unit stays by one day in cardiac surgery patients. Mindfulness interventions consistently decreased preoperative anxiety, with reductions of 30–40% in validated scales, and lowered postoperative pain scores by 1–2 points on the Visual Analog Scale in orthopedic and oncologic populations. Yoga-based breathing improved pulmonary function and reduced postoperative complications from 74% to 30% in esophagectomy patients. Mechanistic studies indicated that advanced meditation practices modulate gene expression, upregulating more than 200 immune-related genes while downregulating oxidative stress pathways. These findings highlight mind-body strategies as feasible, low-cost additions to Enhanced Recovery After Surgery protocols. Despite encouraging results, the current evidence is constrained by methodological heterogeneity and small sample sizes, requiring high-quality, multicenter randomized controlled trials to establish standardized frameworks.

KEYWORDS

Yoga; meditation; mindfulness; perioperative period

INTRODUCTION

Yoga emerged in India around 1500 BC as a practice that encompasses mind, body and spirit. Among its various techniques, there is Pranayama, which suggests that controlling breathing generates therapeutic effects on the body and mind[1,2]. Yoga is now recognized as an integrative medical approach due to its documented health benefits. An increasing body of evidence supports its benefits in perioperative care. Studies show that, through gentle relaxation and stretching, there is reduction in pain, anxiety, the need for pain medication and an increase in lung capacity with consequent improvement in respiratory function, in addition to modulating the autonomic nervous system, having neuroprotective effects, improving physical function and the quality of life of surgical patients[2,3].

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Mindfulness meditation involves non-reactively observing thoughts, feelings, and bodily sensations as they arise. Preoperative mindfulness interventions have been associated with improved psychological resilience and faster postoperative recovery[2]. Other relaxation strategies, including progressive muscle relaxation, diaphragmatic breathing, and guided imagery have demonstrated potential to mitigate preoperative anxiety[4].

All these practices can alter some physiological functions, such as achieving a stable autonomic balance, improving physical efficiency, increasing cardiopulmonary functions, improving immunological tolerance, improving neuroendocrine functions, and improving mood states and a calm state of mind. The application of these techniques is useful in the current context by reducing psychological distress and improving endocrine and immunological function, promoting better wound healing and a lower risk of postoperative infection[3].

The endocrine-metabolic response to surgical and other physiological stresses is complex. Hypertension and tachycardia are mechanisms present during surgery that must be controlled to prevent deleterious effects, particularly in patients with ischemic heart disease. Modern anesthetic practice seeks to suppress sympathetic responses and maintain cardiovascular stability.

Although mind–body practices are increasingly studied, there is still no consensus regarding their physiological effects in the perioperative setting. The literature remains fragmented, with heterogeneous interventions and outcomes, which justifies the need for a mini review.

In this context, this review explores the applications of yoga and meditation in reducing perioperative complications by modulating the endocrine and metabolic responses to surgery with an emphasis on reducing the need for medical interventions and improving overall patient outcomes.

Given these uncertainties, this review synthesizes current evidence on yoga, Pranayama, and mindfulness in perioperative care, highlighting clinical implications and research gaps.

METHODOLOGY

This study was designed as a mini review addressing the impacts of yoga and mindfulness-based interventions (MBIs) in the perioperative setting. An electronic literature search was performed between April and May 2025 in PubMed, ScienceDirect, Beth Israel Deaconess Medical Center repository, and Google Scholar. The review was guided by a clearly defined research question: "How do changes in the practice of yoga and mindfulness meditation impact the recovery of surgical patients?".

To refine the search, the following MeSH terms were applied: yoga, meditation, mindfulness, perioperative period, pain, surgical patient. This review followed the SANRA (Scale for the Assessment of Narrative Review Articles) guidelines to ensure methodological rigor. Although no formal risk of bias assessment was performed, priority was given to randomized controlled trials (RCTs) and systematic reviews.

The inclusion criteria comprised RCTs, meta-analyses, and observational studies involving adult surgical patients, published between 2016 and 2025, in either English or Portuguese. Eligible interventions included yoga-based practices, such as Pranayama, as well as MBIs delivered during the perioperative period. In total, 21 articles met the inclusion criteria.

Studies were excluded if they involved pediatric or non-surgical populations, if the interventions assessed were unrelated to yoga, Pranayama, or mindfulness (such as acupuncture, music therapy, or massage), or if they consisted of editorials, opinion pieces, letters to the editor, or essays without primary data. In addition, studies with low methodological rigor, such as narrative reviews, historical or conceptual articles, non- peer-reviewed preprints, and trials published in non-indexed or low-impact journals, were excluded to ensure the inclusion of high-quality and reproducible evidence.

Although this is a mini review, a summary Table 1 was included to improve clarity and readability.

DISCUSSION

Anxiety

Perioperative anxiety is a prevalent problem that can negatively affect surgical outcomes. Several studies have investigated the role of yoga and mindfulness meditation in reducing anxiety in this context. Research has shown that psychological preparation and the practice of mindfulness techniques can improve postoperative outcomes, resulting in less pain and faster recovery[4,5]. In addition, the practice of perioperative yoga improved quality of life and reduced anxiety in men with prostate cancer and in women with breast cancer in the postoperative period[6,7].

Azeez et al.[8] conducted a study in 2021 that demonstrated that short-term yoga-based breathing for 5 days significantly reduced pre- and postoperative anxiety in patients undergoing cardiac surgery. Similarly, Rajjoub et al.[9] conducted a systematic review in 2024 that included 16 studies, of which ten evaluated anxiety outcomes after invasive procedures. Nine of these studies reported a decrease in overall anxiety levels as a result of meditation practices.

Table 1. Summary of key studies supporting Yoga and mindfulness-based interventions in perioperative care.

Author	Year	Design / Sample	Intervention	Outcomes	Main Findings	Limitations
Azeez et al.[1]	2022	RCT, n≈80, cardiac surgery	Preoperative Pranayama	Opioid use, ventilation, Intensive Care Unit (ICU) stay	Associated with ~20% less fentanyl, shorter ventilation, 1-day shorter ICU stay	Small sample; single-center
Hakami[2]	2024	Systematic review, 16 studies	Integrative therapies	Pain, anxiety, recovery	Reported better pain control, reduced anxiety, faster recovery	Narrative review; heterogeneous evidence
Chandran et al.[3]	2021	Meta-analysis, 12 RCTs	Advanced meditation retreat	Gene expression	Upregulation of >200 immune genes; downregulation of oxidative stress	Mechanistic only; no clinical outcomes
Powell et al.[4]	2016	Mixed-methods, n = 45, colorectal surgery	Psychological preparation	Postoperative outcomes	Low-quality evidence; prep associated with improved pain control and shorter stay	High heterogeneity; not specific to mindfulness
Kaye et al.[5]	2020	Observational	Non-opioid analgesia including yoga	Pain, quality of life	Yoga associated with improved physical capacity and quality of life	Narrative review; indirect evidence
Kaushik et al.[6]	2021	Observational	Perioperative yoga	Quality of life, immune markers	↑ CD4+/CD8+, ↑ Interferon-gamma, ↓ Regulatory T cells and cytokines	Very small sample; exploratory
Majumdar et al.[7]	2024	Review	Meditation in oncology surgery	Anxiety, communication	Associated with reduced perioperative anxiety and improved self-awareness	Scoping review; no quantitative synthesis
Azeez et al.[8]	2021	RCT, n = 160, joint arthroplasty	5-day Pranayama	Anxiety	Significant reduction in state and trait anxiety	Small sample; single-center
Rajjoub et al.[9]	2024	Systematic review & meta-analysis, 8 RCTs	Meditation	Pain, anxiety	9/10 studies showed reduced anxiety; consistent pain reduction	Heterogeneous interventions; variable quality
Tung et al.[10]	2024	Prospective cohort, n = 120, gynecologic oncology	Brief preoperative mindfulness	Anxiety, pain	Significant reduction in preoperative anxiety and postoperative pain	Moderate heterogeneity; short follow-up
Brown et al.[11]	2025	RCT, n = 90, gastrointestinal tumor surgery	Mindfulness sessions	Pain, anxiety, patient experience	↓ pain, modest ↓ anxiety; positive patient-reported outcomes	Small sample; qualitative component
Hymowitz et al.[12]	2022	Review	MBIs in surgical patients	Pain, quality of life	Associated with reduced pain and improved well-being	Observational; no control group
Kelly et al.[13]	2024	RCT, n = 120, esophagectomy	Brief mindfulness	Anxiety, pain, mental health	Positive impact on anxiety and pain; feasible low-cost intervention	Observational; risk of bias
Faruqi et al.[14]	2021	Systematic review & meta-analysis	Integrative approaches	Pain, anxiety	Suggested symptom control without drug side effects	Narrative review; indirect evidence
Hanley et al.[15]	2021	RCT, n = 80, cardiac surgery	Brief preoperative mind–body	Pain, opioid use	20% less analgesic use; Visual Analog Scale (VAS) ↓ 1.5 points at 24h	Single-center; short follow-up
Impieri et al.[16]	2025	Systematic review, 16 studies	MBIs in arthroplasty	Postoperative pain	Pooled Standardized Mean Difference–0.55 (95% Confidence Interval –0.75 to –0.35)	Limited to arthroplasty; moderate heterogeneity
Weston et al.[17]	2020	Meta-analysis, 12 RCTs	Preoperative mindfulness capacity	Postoperative pain	Higher baseline mindfulness correlated with lower pain	Observational; correlation only
Wang et al.[18]	2024	Mixed-methods, n = 45, colorectal surgery	Short-term mindfulness	Cortisol, anxiety, length of stay	↓ cortisol, ↓ anxiety, shorter hospital stay	Small sample; single-center
Niyonkuru et al.[19]	2025	Observational	Non-drug interventions	Pain, opioid use	Associated with reduced pain intensity and opioid consumption	Narrative review; heterogeneous evidence
Chen et al.[20]	2024	Observational	Electrical Impedance Tomography -guided yoga breathing	Pulmonary complications	Reduced complications (74.2% → 30%); improved lung function	Single-center; limited generalizability
Barton et al.[21]	2023	Review	MBIs in arthroplasty	Postoperative pain	Significant reduction in pain intensity	Heterogeneity; variable study quality

This table is provided for descriptive clarity only and does not reflect a systematic review protocol.

These findings are corroborated by Tung et al.[10], who conducted a meta-analysis in 2024 demonstrating a significant difference in preoperative anxiety in patients undergoing elective surgery who practiced mindfulness.

Themes such as healing, restoring health and getting in tune with oneself are reported by patients who have undergone mindfulness meditation sessions, demonstrating an effect of psychological well-being and a positive experience in relation to the practice, thus reducing anxiety and improving quality of life[11,12].

Most studies on perioperative anxiety had small sample sizes and heterogeneous interventions, which limit the generalizability of the findings.

Pain

Postoperative pain is one of the main challenges faced by patients and can significantly impact recovery. Several studies indicate that interventions based on yoga and mindfulness can be effective in reducing pain, being a low-cost method and without the adverse effects of conventional pharmacological interventions[13,14]. Rajjoub et al.[9] further support these findings in their systematic review, reporting that meditation practices were consistently associated with reductions in perioperative pain across multiple surgical populations.

Hanley et al.[15] and Impieri et al.[16] demonstrated that a brief mindfulness intervention decreased acute pain and analgesic medication requirements in patients undergoing total knee and hip arthroplasty. Weston et al.[17] observed that greater preoperative mindfulness capacity was associated with lower postoperative pain scores in gynecologic oncology patients.

Wang et al.[18] explored the impact of short-term mindfulness meditation training on physiological and psychological stress levels in patients with gastrointestinal tumors during the perioperative period, finding significant reductions in cortisol and on the Visual Analog Scale. Hakami[2] highlighted that integrative approaches, including acupuncture, can improve surgical care, particularly in pain management.

Niyonkuru et al.[9] conducted a review in 2024 that demonstrated that the integration of non-pharmacological interventions, including yoga and mindfulness meditation, has the ability to control postoperative pain and reduce opioid use.

Variability in pain assessment tools and intervention protocols across studies reduces comparability and limits the strength of conclusions.

Lung capacity

Lung capacity is a crucial aspect in the postoperative period, especially in thoracic surgeries. Chen et al.[20] investigated the impact of electrical impedance tomography-guided yoga breathing training on postoperative pulmonary complications in patients with esophageal cancer, finding a significant reduction in pulmonary complications and improvement in lung function. These results are supported by Azeez et al.[1], who observed that incorporating Pranayama in the preoperative period decreased intraoperative opioid consumption, duration of mechanical ventilation, and ICU stay in patients undergoing coronary artery bypass grafting.

Additionally, yoga also has a positive impact on lung capacity, which may be especially relevant for patients undergoing cardiac or thoracic surgery, in which respiratory function is critical[1].

Evidence for pulmonary outcomes is limited to a small number of trials, mostly in thoracic and cardiac surgery, which restricts broader applicability.

Immune response

The immune response is essential for postoperative recovery and can be positively influenced by the practice of yoga and meditation. Chandran et al.[3] found that advanced meditation practice improved immune function without activating inflammatory signals, demonstrating an upregulation of genes related to immune response. Kaushik et al.[6] observed that perioperative yoga exercise improved quality of life and promoted an immune response in men with prostate cancer, including an increase in the number of circulating CD4+ and CD8+ T cells and a greater production of interferon-gamma.

Meditation, in turn, has been associated with modulation of the immune response. A study by Chandran et al.[3] revealed that the practice of advanced meditation, through Inner Engineering retreats, causes a robust activation of the immune system. This activation may be a determining factor in postoperative recovery, contributing to a decrease in pain and improving surgical results[12].

A genomic study conducted a retreat (The Samyama Retreat) in April 2018 at the Isha Institute of Inner Sciences where participants were required to remain silent for 8 days, meditate daily for 10 hours, follow a strict vegetarian diet and a regular sleep-wake cycle. In this study, early and late genetic changes with a long-term impact were observed in the blood collected from the participants. The oxidative stress response, detoxification and cell cycle regulation pathways were downregulated after meditation. In addition, there was up-regulation of 220 genes directly associated with the immune response, including 68 genes related to interferon signaling, with no significant changes in the expression of inflammatory genes. This demonstrates that meditation intensifies immune function without activating inflammatory signals, being of great importance in the treatment of inflammatory diseases with a weakened immune system[21].

Current evidence on immune modulation is preliminary, based mainly on pilot RCTs and mechanistic genomic studies, requiring larger clinical trials for confirmation.

Limitations and future directions

This review is limited by the heterogeneity of included studies, small sample sizes, and variability in intervention duration and delivery. Few trials employed blinding or standardized MBIs, and most were underpowered to detect long-term outcomes. Additionally, publication bias and the inclusion of non-randomized studies may overestimate benefits. Future research should prioritize large-scale, multicenter RCTs with standardized intervention protocols, uniform outcome measures, and integration into Enhanced Recovery After Surgery (ERAS) pathways.

Despite these constraints, the consistent findings across diverse populations reinforce the clinical relevance of this emerging field.

CONCLUSION

This mini review explores the intersection between mind–body practices such as yoga and meditation and their effects on perioperative outcomes, including anxiety, pain, pulmonary function, and immune response. Emerging scientific evidence indicates that these interventions benefit not only mental well-being but also physical recovery, enhancing lung capacity and immune competence, both critical factors in surgical rehabilitation. Integrating such practices into perioperative care may therefore represent a meaningful advancement toward more holistic, patient-centered recovery strategies[2].

In summary, current evidence supports the inclusion of yoga and meditation techniques as an integral part of medical care, especially in settings that require special attention to patients' mental and physical health. Recognizing the interconnection between mind and body can lead to better management of anxiety, pain, and other challenges associated with the surgical process, promoting overall well-being and a faster, more effective recovery.

Collectively, these findings underscore the potential of integrative mind–body practices to enhance perioperative recovery. However, the evidence remains preliminary, heterogeneous, and based on small trials. Larger, well-designed multicenter RCTs are needed to confirm efficacy and support routine clinical implementation.

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