REVIEW ARTICLE

Preoperative Optimization in Surgical Patients

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ABSTRACT

Preoperative optimization is a critical component in enhancing surgical outcomes and reducing postoperative complications. This review provides a comprehensive approach to managing preoperative care in a primary care setting, emphasizing the importance of risk assessment, patient education, and multidisciplinary collaboration. By focusing on evidence-based strategies such as structured exercise programs, nutritional optimization, glycemic control, and lifestyle modifications, primary care physicians can significantly improve patient

INTRODUCTION

Preoperative optimization is a critical component of modern surgical planning, designed to improve patient outcomes by addressing modifiable risk factors before surgery. By identifying and managing comorbidities, optimizing physiologic reserve, and preparing patients holistically for the stress of surgery, clinicians can reduce complications, shorten hospital stays, and improve recovery trajectories.[1,2] This approach emphasizes a proactive patient-centered model of care that is especially relevant to osteopathic family physicians, who are trained to consider the interconnectedness of body systems, lifestyle, and environment in patient health by applying a multidisciplinary approach.

DEFINITION AND SCOPE

Preoperative optimization involves a systematic evaluation of a patient's current medical conditions, comorbidities, and therapies, with the goal of reducing perioperative complications.[2] Its scope extends beyond routine preanesthesia evaluations, encompassing surgical complexity, anesthesia type, patient-specific characteristics (e.g., age, sex, frailty), and socioeconomic factors such as access to resources and social support.[2,3] The goal is to identify each risk factor and create an individualized plan to minimize its impact on the recovery process. Interventions may include lifestyle modifications such as smoking cessation, structured exercise programs to improve physiologic reserve, or management of conditions like anemia or diabetes.[2] Identify risk factors and create an individualized plan to minimize their impact on recovery. Interventions may include lifestyle modifications, nutrition, exercise, glucose management, cardiac management, psychological factors, and patient education, among others. Preoperative optimization is vital because it reduces complications, strengthens recovery, shortens hospital stays, lowers costs, and improves overall patient quality of life.

In practice, preoperative optimization is often initiated through a preanesthesia assessment clinic, where anesthesia providers review the surgical plan and evaluate cardiopulmonary risk factors.[2] Traditional preoperative clinics primarily focus on cardiopulmonary risk stratification, but their scope can be limited. In such settings, broader risk factor management, such as nutritional support, smoking cessation, or psychosocial interventions, is often deferred to the primary care provider.[3] By contrast, comprehensive optimization clinics provide individualized multidisciplinary plans that address the full spectrum of risk factors. These may include exercise and nutrition

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interventions, glycemic and cardiovascular management, and behavioral modifications such as alcohol and tobacco cessation. Patients may also be referred to specialists such as nutritionists, physical therapists, and internists, ensuring a coordinated whole-patient approach to surgical readiness.[3,4] Osteopathic family physicians serve as a valuable resource for preoperative optimization, providing a comprehensive review and plan tailored to each patient. Follow-up after surgery ensures that interventions begun preoperatively continue into the recovery phase. A noted limitation of both models, however, is that management of risk factors outside the surgical scope often falls to the patient's primary care provider, and multiple follow-up appointments may extend the timeline before surgery.[2]

IMPORTANCE OF PREOPERATIVE OPTIMIZATION

Preoperative optimization is essential because it reduces surgical risk, enhances recovery, and improves long-term health outcomes. Addressing modifiable risk factors before surgery decreases the incidence of complications such as infection, delayed wound healing, respiratory failure, and cardiovascular events.[5] Patients who undergo structured optimization demonstrate improved resilience, shorter hospital stays, and lower readmission rates.[5,6]

Equally important, preoperative optimization aligns with a patient-centered preventive care model. It empowers patients through education, lifestyle interventions, and active participation in their own recovery. This not only improves surgical outcomes but also promotes long-term health behaviors that extend beyond the perioperative period.[6,7]

From a systems perspective, effective preoperative optimization lowers healthcare costs by reducing postoperative morbidity, minimizing intensive-care utilization, and preventing avoidable readmissions.[7] It also fosters multidisciplinary collaboration among surgeons, anesthesiologists, family physicians, nutritionists, physical therapists, and other specialists—ensuring coordinated care tailored to the individual patient.

EVIDENCE-BASED STRATEGIES FOR PREOPERATIVE OPTIMIZATION

Structured preoperative exercise (prehabilitation) significantly enhances physiologic reserve and surgical outcomes. A systematic review of 186 randomized trials found that targeted exercise prehabilitation reduced postoperative complications by nearly 50% compared to usual care.[1] Aerobic conditioning improves cardiovascular and pulmonary function, while resistance training increases muscle strength and independence.

TABLE 1: Preoperative Optimization Timeline.

Domain	Several Months Available	Only a Few Weeks Available
Initial assessment	Full H and P, labs (CBC, electrolytes, albumin), ECG (if indicated), ASA/ RCRI risk calculators. Referrals to specialists (cardiology, pulmonology, endocrinology, geriatrics).[16-21]	Immediate comprehensive assessment (labs, ECG if indicated, ASA/ RCRI). Triage for urgent specialist input only if it will change perioperative management.[16-21]
Lifestyle (smoking and alcohol)	≥4 weeks of smoking cessation halves complication risk. Alcohol reduction/cessation improves immune and hepatic function.[10]	Even 2 weeks of abstinence lowers risk—initiate immediately. Provide nicotine replacement and withdrawal management.[9]
Nutrition	Formal dietitian referral. High-protein intake (1.2-1.5 g/kg/d), micronutrient support (vitamin A, C, zinc). Long-term weight management if BMI >30-35.[4,5]	Rapid protein supplementation (oral nutrition shakes), micronutrient boost. Screen with MUST/PG-SGA and correct deficits quickly.[4]
Exercise/ "prehabilitation"	Structured aerobic (3-5x/ wk) + resistance (2-3x/ wk). Improves VO_2max, functional reserve, and independence.[1,3]	Short daily aerobic exercise (walking, cycling) and light resistance training. Even 2 weeks improves outcomes in frail/high-risk patients.[1]
Glycemic optimization	Goal A1C <8% over weeks. Adjust oral medications, insulin regimens.[6,7]	Perioperative target 100-180 mg/dL. Hold metformin DOS, stop SGLT2i 3-4 days prior. Simplify regimen to basal/ bolus insulin if needed.[6-8]
Cardiac/HTN management	Optimize BP <140/90. Continue β-blockers, most antihypertensives. Stop ACE/ ARB the morning of surgery. Start β-blockers if indicated (≥1 month before).[11,12]	Continue β-blockers and most antihypertensives. Hold ACE/ARB on DOS. Avoid new cardiac meds unless urgent[12]
Anticoagulation	Plan bridging strategies with specialists. Tailor to the surgery type and patient risk.[11,12,16]	Stop DOAC 1-2 days before (low- vs high-risk procedure). Restart 1-2 days postoperative if safe. Warfarin bridging only if absolutely indicated.[11,12,16]
Psychological prep	Counseling, CBT, structured stress-reduction programs. Build resilience and coping skills.[32-34]	Focused anxiety reduction: brief counseling, relaxation, breathing techniques.[32-34]
Patient education	Multiple touchpoints: expectations for recovery, pain control, nutrition, mobility. Shared decision-making is emphasized.[22-25]	One focused session: surgery risks, NPO instructions, postoperative expectations, and discharge planning.[22-25]
Final week	Reassess nutrition/albumin, functional capacity. Review medication adjustments. Begin carbohydrate-loading plan.[5-8]	Stop SGLT2i 3-4 days prior. Hold metformin and ACE/ ARB DOS. Carbohydrate loading if appropriate. Confirm logistics.[5-8]
Day of surgery	Continue β-blockers, most antihypertensives. Glucose monitoring. Confirm smoking/alcohol abstinence.[6-8,11,12]	Same—focus on medication reconciliation, glucose control, and perioperative monitoring.[6-8,11,12]

ACE, angiotensin-converting enzyme; ARB, angiotensin II receptor blocker; ASA, American Society of Anesthesiologists; BP, blood pressure; RCRI, Revised Cardiac Risk Index; BMI, body mass index; CBC, complete blood count; CBT, cognitive behavioral therapy; DOAC, direct-acting oral anticoagulant; DOS, day of surgery; ECG, electrocardiogram; HTN, hypertension; MUST, Malnutrition Universal Screening Tool; PG-SGA, Patient-Generated Subjective Global Assessment; SGLT2i, sodium-glucose cotransporter 2 inhibitor; VO_{2max}, maximum rate of oxygen the body uses during intense exercise

High-risk patients, such as older adults or low baseline fitness, benefit most from a tailored regimen combining moderate-intensity aerobic exercise (walking or cycling 3-5 times weekly) with progressive resistance training (2-3 times weekly).[1,3] Clinically, positive outcomes include fewer postoperative complications, shorter hospital stays, and improved functional recovery, measurable by tests such as the six-minute walk test and sit-to-stand performance.

Nutritional optimization plays a central role in recovery, influencing wound healing, infection rates, and postoperative resilience. Adequate protein intake (1.2-1.5 g/kg/d) initiated at least 1-2 weeks preoperatively preserves lean mass, enhances strength, and reduces complications by up to 30%.[4] Supplementation with vitamins A, C, and zinc promotes collagen synthesis and immunity, thereby accelerating wound healing and reducing surgical-site infections. Carbohydrate loading (45-50 g complex carbohydrates, 2-3 hours before induction) mitigates insulin resistance, perioperative nausea and thirst, and shortens hospital stay.[5] Screening tools such as MUST or PG-SGA identify malnutrition, while weight-management programs in obese patients improve metabolic profiles and lower perioperative morbidity.[5] Evidence shows nutritional optimization leads to faster wound healing, fewer infections, preserved muscle mass, improved functional/nutritional status, shorter hospital stays, and fewer readmissions.

Glycemic optimization targets A_{1C} below 8% to reduce the risks of infection, impaired wound healing, and prolonged hospitalization. Evidence shows that chronic hyperglycemia impairs neutrophil function and collagen synthesis, while perioperative glucose levels above 180 mg/dL significantly increase infection rates.[6-8] Management strategies include: holding metformin on the day of surgery to prevent lactic acidosis, discontinuing SGLT2is 3-4 days preoperatively to avoid ketoacidosis, and adjusting long-acting insulin to 75%-80% of the usual dose. Intraoperative and postoperative glucose levels are best managed with basal-bolus insulin regimens, monitored every 2-4 hours, while sliding-scale insulin alone is discouraged. Measured benefits include lower surgical-site infection rates, improved wound healing, shorter hospital stays, and reduced readmission for hyperglycemia-related complications.

Smoking cessation initiated 3-4 weeks before surgery halves postoperative complication rates, reducing overall complication rates from 41%-21%.[9] Smoking cessation improves pulmonary function, tissue oxygenation, and wound-healing capacity. Similarly, preoperative alcohol reduction reverses impairments in immune response, coagulation, and liver metabolism, lowering the risk of infections and bleeding complications.[10] Outcomes include fewer cardiopulmonary complications, improved wound healing, reduced infection rates, and shorter hospital stays, often measured through complication incidence and pulmonary function tests.

Medication optimization, including anticoagulation and cardiovascular drugs, ensures perioperative safety. A balance of bleeding and thromboembolic risks guides anticoagulation management. For patients on DOACs, medications are stopped 1 day before and restarted 1 day after low- to moderate-risk procedures, and 2 days before and after high-risk procedures, per American College of Cariology (ACC) guidelines.[11,12] Most antihypertensive agents are continued until the day of surgery, except for ACE inhibitors and ARBs, which are withheld the morning of surgery to minimize intraoperative hypotension. β-blockers are continued perioperatively to reduce cardiac events, consistent with American Heart Association (AHA) guidelines.[12] Outcomes include reduced intraoperative hypotension, fewer bleeding complications, decreased perioperative cardiac events, and improved overall safety during the perioperative period.

OMT has the potential to optimize preoperative resilience further. In the evolving landscape of multimodal surgical care, such as Enhanced Recovery After Surgery (ERAS) protocols, OMT has emerged as an integrative adjunct worth consideration. A 2018 summative review of OMT use in surgical care found limited but meaningful evidence across abdominal, thoracic, gynecologic, and orthopedic surgeries, with measured outcomes including postoperative pain, analgesic use, length of stay (LOS), and range of motion.[13] Though only 10 studies were identified, they revealed a mixed profile, some demonstrating benefits while others did not, reflecting considerable heterogeneity in the surgical context, OMT technique, provider experience, and timing.[13] The OMT techniques used within the studies were high-velocity, low-amplitude (HVLA), myofascial release, muscle energy, rib raising, strain/counterstrain, lymphatic techniques, occipito-atlantal decompression, etc. Notable findings included reduced pain, decreased opioid consumption, shorter hospitalization, and improved mobility in some instances, though generalizability remains limited by variability in study design. As manual therapies, such as OMT, gain traction within integrative surgical frameworks, further robust controlled studies are urgently needed to clarify their role in preoperative preparation and postoperative recovery.

RELATIONSHIP BETWEEN PREOPERATIVE CONDITIONS AND POSTOPERATIVE OUTCOMES

Medical optimization during the preoperative period is essential to reducing postoperative complications and improving recovery. Patient factors such as age, BMI, serum albumin levels, tobacco use, and insulin-dependent diabetes mellitus have all been shown to significantly influence outcomes.[14] For example, in patients undergoing total knee arthroplasty, those with a BMI greater than 40

kg/m², hypoalbuminemia (<3.5 g/dL), active tobacco use, and insulin-dependent diabetes demonstrated higher rates of infection, readmission, and overall complications compared to optimized patients.[14] These complications ranged from wound infections and pneumonia to thromboembolic events, cardiac complications, and even mortality.[14] Importantly, patients who were not medically optimized experienced infection, readmission, and complication rates that were 0.7%, 1.6%, and 1.3% higher, respectively, than their optimized counterparts.[14]

Among these risk factors, nutritional status is one of the most influential. Poor nutrition is associated with a 3.7-fold increase in postoperative infection and a 7.2-fold increase in 30-day mortality.[14] Similarly, in surgical patients with head and neck cancer, higher preoperative albumin levels, a marker of nutritional health, were correlated with fewer complications and better recovery.[15] These findings underscore the critical role of holistic preoperative optimization, particularly in nutrition, to reduce complications and promote resilience. For osteopathic family physicians, who emphasize preventive whole-patient care, early identification and management of these modifiable risk factors represents a powerful opportunity to improve surgical outcomes while supporting long-term health.

PREOPERATIVE SCREENING AND RISK ASSESSMENT

Comprehensive preoperative screening is essential for optimizing patient outcomes and reducing perioperative risk. For osteopathic family physicians, this evaluation represents not only a medical assessment but also an opportunity to understand the patient holistically, considering comorbidities, functional capacity, and psychosocial supports that may influence recovery.

TABLE 2: Domains optimized and expected outcomes.

Domain Optimized	Improved Outcomes (Evidence-Based)
Smoking cessation (≥4 weeks)	↓ Postoperative pulmonary complications, ↓ wound infection rates, improved oxygenation, ↓ ICU admissions.[9]
Alcohol reduction (≥4 weeks)	↓ Wound complications, ↓ cardiopulmonary complications, improved immune function, ↓ postoperative delirium.[10]
Nutrition optimization	↓ Surgical-site infection, ↓ anastomotic leak rates, shorter LOS, improved wound healing.[4,5,15]
Prehabilitation (exercise training)	↑Functional recovery, ↑ VO_2max, and mobility, ↓ postoperative complications, and faster return to independence.[1,3]
Glycemic control	↓ Surgical site infections, ↓ cardiovascular complications, ↓ risk of delayed wound healing.[6-8]
Anemia correction (iron, EPO, transfusion planning)	↓ Perioperative transfusions, ↓ infections, improved wound healing, ↓ mortality[14]
Cardiac optimization (β-blockers, HTN control)	↓ Myocardial infarction, ↓ arrhythmias, ↓ cardiac-related morbidity/mortality.[12]
Anticoagulation/antiplatelet planning	↓ Perioperative bleeding, ↓ thromboembolic events, and safer surgical hemostasis.[11,12]
Psychological preparation (counseling, CBT)	↓ Anxiety, ↓ postoperative pain scores, ↓ opioid use, ↑ patient satisfaction.[32-34]
Patient education and shared decision-making	↑ Adherence to perioperative instructions, ↓ unplanned readmissions, ↑ satisfaction, and smoother discharge.[22-25]
ERAS-style multimodal approach	↓ LOS, ↓ complications, ↓ readmission, and faster return to baseline function.[3]

EPO, erythropoietin

Standard preoperative testing may include laboratory studies (CBC, electrolytes), imaging (such as chest radiographs), and ECGs. However, both the ASA and ACC/AHA recommend ordering these studies selectively, based on patient characteristics and surgical risk, rather than indiscriminately.[12,16] For example, ECGs are indicated for patients with known cardiovascular disease or undergoing high-risk surgery, but not for asymptomatic patients undergoing low-risk procedures.[12]

Risk assessment also involves identifying modifiable conditions that, if addressed, improve surgical outcomes. Preanesthetic evaluations highlight chronic conditions such as diabetes, HTN, and chronic obstructive pulmonary disease (COPD), as well as medication reconciliation to minimize drug-related risks.[17] Lifestyle factors, including smoking and poor nutrition, remain critical targets for intervention, with evidence showing that cessation and nutritional optimization reduce complications and support recovery.[18]

Validated risk stratification tools strengthen this process. The ASA physical status classification and RCRI are widely used, with the RCRI effectively stratifying patients into low (<1%) or high (≥1%) risk for major adverse cardiovascular events.[19] Specialty calculators, such as the STS Predicted Risk of Mortality or EUROSCORE II, are particularly valuable for cardiac or high-risk surgical populations.[20] Additionally, the American Geriatrics Society supports comprehensive geriatric assessments, which tailor preoperative plans to the needs of older adults, improving recovery and reducing complications.[21]

Notably, patients with significant comorbidities, such as obesity, smoking, diabetes, or COPD, are flagged as higher risk and may benefit from targeted interventions such as intensive prehabilitation or specialist consultations.[18,21] By integrating these tools and assessments, osteopathic

family physicians can proactively identify vulnerabilities and design individualized optimization strategies that reduce complications, support surgical recovery, and enhance long-term health.

ROLE OF PATIENT EDUCATION IN PREOPERATIVE OPTIMIZATION

Education on Surgical Risks and Expectations

Preoperative education is a cornerstone of surgical preparation, ensuring patients are well informed, engaged, and empowered to participate in their care. From an osteopathic perspective, this process extends beyond simply listing risks; it is about addressing the patient as a whole, medically, emotionally, and socially, to optimize outcomes and recovery. Research shows that comprehensive preoperative education improves the informed consent process by enhancing patient understanding of potential complications and empowering shared decision-making.[22] Tailoring education to an individual's health status and personal risk factors not only strengthens comprehension but also reduces preoperative anxiety and promotes adherence to medical recommendations.[23] By clarifying expectations, physicians can help patients approach surgery with greater confidence and preparedness.

Equally important, education provides patients with a realistic framework for postoperative recovery. Structured preoperative programs, such as those studied in colorectal cancer populations, have been shown to improve coping strategies, reduce stress, and enhance adherence to recovery protocols.[24] Similarly, patients undergoing abdominal surgery who received detailed education demonstrated better outcomes, including lower anxiety, improved satisfaction, and fewer postoperative complications.[25] Practical discussions about anticipated pain levels, activity restrictions, and common recovery milestones help bridge the gap between expectation and reality, which reduces risk of dissatisfaction or unnecessary readmissions.

For osteopathic family physicians, preoperative education presents an opportunity to practice whole-person care, acknowledging the patient's physical, mental, and social dimensions. By investing time in discussing risks, expectations, and recovery pathways, physicians not only support safer surgeries but also cultivate trust, resilience, and active patient participation in their own healing.

PREOPERATIVE LIFESTYLE MODIFICATIONS

Lifestyle modifications in the preoperative period are powerful evidence-based strategies that directly influence surgical outcomes. For osteopathic family physicians, this stage of care provides a unique opportunity to guide patients toward healthier behaviors that not only reduce perioperative risks but also promote long-term wellness. Patient education is central to this process, empowering individuals to make informed decisions that enhance their surgical recovery and overall health.

Smoking cessation is one of the most impactful interventions, with studies demonstrating that quitting at least several weeks before surgery reduces pulmonary complications and wound infections.[26,27] Similarly, preoperative alcohol reduction improves immune function, hemostasis, and metabolism, lowering the likelihood of postoperative complications.[28] Importantly, recommendations for behavioral change should be tailored to align with each patient's readiness and preferences, whether focusing on short-term preoperative goals or longer-term health improvements.[28]

Nutritional and hydration counseling further enhances surgical preparedness. Research highlights that targeted dietary education, particularly in populations undergoing complex procedures such as esophageal surgery, optimizes recovery and improves resilience to surgical stress.[29] Adequate hydration and balanced nutrition strengthen immune function, promote wound healing, and reduce hospital LOS, underscoring the value of comprehensive preoperative lifestyle counseling.

By integrating these evidence-based interventions, osteopathic family physicians can address both the physiologic and behavioral dimensions of care. This approach reinforces the osteopathic commitment to preventive medicine, empowering patients to actively participate in their surgical journey while laying a foundation for healthier living beyond the perioperative period.

PSYCHOLOGICAL PREPARATION

Psychological readiness is a critical component of preoperative optimization. Unmanaged anxiety and fear can increase postoperative pain, prolonged hospital stays, and raise complication rates. Structured interventions, such as guided relaxation, mindfulness, and cognitive-behavioral strategies, have been shown to reduce preoperative anxiety and improve patient confidence, helping patients feel more in control and prepared for surgery.[30] Studies further emphasize that unmanaged preoperative anxiety can contribute to increased postoperative pain, prolonged hospital stays, and higher complication rates.[31]

Psychological prehabilitation programs that focus on stress management and resilience-building further support recovery by reducing stress-induced physiologic responses.[32] Integrating these strategies into preoperative

care aligns with the osteopathic principle of whole-person medicine, promoting not only improved surgical outcomes but also enhanced overall patient well-being and quality of life.

PATIENT EMPOWERMENT AND ENGAGEMENT

Patient education plays a pivotal role in preoperative optimization by fostering patient empowerment and engagement, leading to improved surgical outcomes. Encouraging patients to actively participate in their preoperative care, such as managing chronic conditions, adhering to prescribed medications, and engaging in lifestyle modifications, enhances their sense of control and preparedness for surgery.[33] This proactive approach, known as "prehabilitation," has been shown to improve resilience and recovery, particularly in surgical oncology patients.

Additionally, open communication between patients and healthcare providers is essential for addressing concerns, setting realistic expectations, and ensuring adherence to preoperative guidelines.[34] Research highlights that structured patient engagement strategies, including shared decision-making and personalized education, lead to greater patient satisfaction and reduced perioperative complications.[35] By prioritizing patient empowerment and fostering collaborative communication, healthcare teams can enhance surgical preparedness and optimize postoperative recovery.

MULTIDISCIPLINARY COLLABORATION IN PREOPERATIVE OPTIMIZATION

Multidisciplinary collaboration in preoperative optimization is essential for improving surgical outcomes, particularly in complex and high-risk patients. A team-based approach involving surgeons, anesthesiologists, nutritionists, physiotherapists, and other specialists ensures comprehensive patient evaluation and targeted interventions to optimize perioperative care.[36] Preoperative clinics and case managers play a crucial role in coordinating these efforts, streamlining communication, and ensuring timely implementation of necessary prehabilitation strategies.[37] Additionally, interdisciplinary collaboration has been shown to reduce postoperative complications by addressing modifiable risk factors and enhancing perioperative decision-making.[38] For instance, in complex surgical cases such as spine and cardiac procedures, structured multidisciplinary care has demonstrated improvements in patient outcomes, emphasizing the value of integrated team-driven strategies in surgical optimization.[39]

CONCLUSION

This review provides a comprehensive overview of current evidence-based strategies in preoperative optimization, including risk assessment, targeted interventions, patient education, and multidisciplinary collaboration, all aimed at reducing postoperative complications and promoting recovery. Primary care physicians, particularly in osteopathic family medicine, play a crucial role in implementing these strategies while fostering patient empowerment and engagement to improve surgical outcomes and quality of life. Despite strong evidence supporting many perioperative interventions, further research is needed to evaluate the specific efficacy of preoperative OMT and its integration into holistic preoperative care. Expanding the evidence base for OMT may help optimize surgical preparedness and enhance postoperative recovery in diverse patient populations.

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