



Enhanced recovery after surgery (ERAS®) society guidelines for gynecologic oncology: 2026 update[☆]

Gregg Nelson^{a,b,*}, Alon D. Altman^c, Amy Metcalfe^d, Christina Fotopoulou^e, Jolyn Taylor^f, Gretchen Glaser^g, Jamie Bakkum-Gamez^g, Amanika Kumar^g, Larissa A. Meyer^f, Rebecca Stone^h, Gabriel Menaⁱ, Kevin M. Elias^j, Steven P. Bisch^a, Oliver Zivanovic^k, Ester Miralpeix^l, Geetu Bhandoria^m, Ane Gerda Zahl Erikssonⁿ, Shannon M. Ruzyski^o, Pervez Sultan^p, Khara M. Sauro^q, Lindsay Blake^r, Mary E. Brindle^{b,s}, Pedro T. Ramirez^{t,†}, Sean C. Dowdy^{g,†}

^a Department of Obstetrics & Gynecology, Cumming School of Medicine, University of Calgary, Calgary, Alberta, Canada

^b Ariadne Labs, Brigham and Women's Hospital, Harvard T.H. Chan School of Public Health, Boston, MA, USA

^c Department of Obstetrics, Gynecology and Reproductive Sciences, University of Manitoba, Winnipeg, Manitoba, Canada

^d Departments of Obstetrics and Gynecology, Medicine, and Community Health Sciences, University of Calgary, Calgary, Alberta, Canada

^e Department of Surgery and Cancer, Faculty of Medicine, Imperial College London, London, UK

^f Department of Gynecologic Oncology and Reproductive Medicine, The University of Texas MD Anderson Cancer Center, Houston, TX, USA

^g Division of Gynecologic Oncology, Mayo Clinic College of Medicine, Rochester, MN, USA

^h Department of Gynecology and Obstetrics, Johns Hopkins School of Medicine, Baltimore, MD, USA

ⁱ Department of Anesthesiology, Critical Care and Pain Medicine, The University of Texas MD Anderson Cancer Center, Houston, TX, USA

^j Section of Gynecologic Oncology, Obstetrics and Gynecology Institute, Cleveland Clinic Foundation, Cleveland, OH, USA

^k Heidelberg University Hospital, Department of Obstetrics and Gynecology, Heidelberg, Germany

^l Department of Obstetrics and Gynecology, Gynecological Cancer Multidisciplinary Unit, Hospital del Mar Research Institute, Barcelona, Spain

^m Department of Gynecologic Oncology, Command Hospital, Kolkata, India

ⁿ Department of Gynaecological Oncology, The Norwegian Radium Hospital, Oslo University Hospital, Oslo, Norway

^o Departments of Medicine, and Community Health Sciences, University of Calgary, Calgary, Alberta, Canada

^p Department of Anesthesiology, Perioperative and Pain Medicine, Stanford University School of Medicine, Stanford, CA, USA

^q Departments of Surgery, Community Health Sciences, Oncology, Cumming School of Medicine, University of Calgary, Calgary, Alberta, Canada

^r UAMS Library, University of Arkansas for Medical Sciences, Little Rock, AR, USA

^s Department of Surgery, Cumming School of Medicine, University of Calgary, Calgary, Alberta, Canada

^t Department of Obstetrics and Gynecology, Houston Methodist Hospital, Houston, TX, USA

HIGHLIGHTS

- The third updated review of the ERAS® Society gynecologic oncology guidelines is presented.
- This guideline will help integrate knowledge into practice and align perioperative care globally.
- ERAS teams are encouraged to adopt these recommendations and standardize perioperative pathways where possible.

ARTICLE INFO

Article history:

Received 16 May 2026

Accepted 22 May 2026

Available online 6 June 2026

Keywords:

Enhanced recovery after surgery

ERAS

ABSTRACT

Background. This is the third updated enhanced recovery after surgery (ERAS®) society guideline presenting a consensus for optimal perioperative care in gynecologic oncology surgery.

Methods. A database search of publications using Embase and PubMed was performed (2018–2025). Studies for key elements within the ERAS gynecologic oncology protocol were selected with emphasis on meta-analyses, randomized controlled trials, and large prospective cohort studies. These studies were then reviewed and graded according to the grading of recommendations, assessment, development and evaluation (GRADE) system.

[☆] These guidelines were presented in part at the 12th ERAS World Congress in Singapore, on May 14, 2026.

^{*} Corresponding author at: Department of Obstetrics & Gynecology, Cumming School of Medicine, University of Calgary, 1331 29th St NW, Calgary, Alberta T2N 4N2, Canada.

E-mail address: gregg.nelson@ahs.ca (G. Nelson).

[†] SCD and PTR contributed equally to this article.

Perioperative care
Surgical quality
Gynecologic oncology surgery

Results. All recommendations on ERAS protocol items are based on best available evidence. The level of evidence for each item is presented accordingly.

Conclusions. The updated evidence base and recommendation for items within the ERAS gynecologic oncology perioperative care pathway are presented by the ERAS® society in this consensus review. Gynecologic surgeons may consider incorporating these recommendations into perioperative pathway design, with efforts to achieve consensus within their practice where feasible.

© 2026 The Authors. Published by Elsevier Inc. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Contents

1.	Introduction	154
2.	Methods	154
2.1.	Formation of the guideline development group.	154
2.2.	Literature search	155
2.3.	Quality assessment	155
3.	Results	155
3.1.	Preadmission information, education and counselling.	155
3.2.	Prehabilitation	155
3.3.	Preoperative optimization and frailty assessment.	158
3.3.1.	Anemia	158
3.3.2.	Alcohol, tobacco use.	158
3.3.3.	Frailty assessment.	158
3.4.	Preoperative bowel preparation.	158
3.5.	Preoperative fasting and carbohydrate treatment.	159
3.6.	Preoperative medications	160
3.7.	Venous thromboembolism prophylaxis	160
3.8.	Surgical site infection (SSI) reduction bundles	161
3.8.1.	Antimicrobial prophylaxis	161
3.8.2.	Skin preparation	161
3.8.3.	Prevention of hypothermia.	161
3.8.4.	Wound closure techniques.	162
3.8.5.	Avoidance of perioperative hyperglycemia.	162
3.9.	Standard anesthetic protocol	163
3.10.	Perioperative fluid management and goal-directed fluid therapy	164
3.11.	Minimally invasive surgery (MIS)	164
3.12.	Opioid sparing postoperative analgesia.	164
3.13.	Urinary drainage	165
3.14.	Early mobilization	165
3.15.	Discharge pathways	165
3.16.	Audit and reporting	166
4.	Summary	166
	CRedit authorship contribution statement.	166
	Funding	167
	Appendix A. Supplementary data	167
	References	167

1. Introduction

Enhanced Recovery After Surgery (ERAS) is now a well-established, internationally adopted surgical quality improvement program that delivers demonstrable clinical benefits and cost savings for the healthcare system [1–3]. Because ERAS guidelines are grounded in the highest-quality available evidence, periodic revision is required [4]. The ERAS Gynecologic Oncology guidelines were first published in 2016 [5,6], with subsequent updates in 2019 [7] and 2023 [8]. This document represents the third update of the ERAS® Society guidelines for gynecologic surgery, presenting the latest evidence and recommendations for key components of the perioperative care pathway. These updates are intended to support optimal management of patients undergoing surgery for gynecologic indications, including both minimally invasive and open procedures.

2. Methods

Standard ERAS® Society Guideline methodology was adhered to [4] and the guideline proposal was approved by the ERAS® Society Guidelines Committee (August 2025).

2.1. Formation of the guideline development group

International authors with expertise in gynecologic oncology perioperative care and guideline methodology were invited to participate in the guideline update. The group consisted of 24 authors, including 17 gynecologic oncologists, 2 anesthesiologists, 1 internal medicine specialist, 1 PhD epidemiologist, 1 PhD health services researcher, 1 academic librarian and 1 independent expert surgeon appointed by the ERAS® Society (MB). All members were experienced in research methods and critical evaluation.

2.2. Literature search

The literature search (2018 to 2025) was conducted by an academic librarian (LB) using the Embase, PubMed MEDLINE, Scopus, and Web of Science databases to search controlled vocabulary (medical subject headings) and key words that included “gynecology”, “gynecologic oncology”, and all previous pre-, intra-, and post-operative ERAS Gynecologic Oncology items [5–8]. The search focused on randomized clinical trials and large observational studies (≥800 patients) to maximize search feasibility and relevance. The reference lists of all eligible articles were cross-checked with those of other relevant studies.

2.3. Quality assessment

The quality of evidence and recommendations were evaluated by one or two authors per item according to the Grading of Recommendations, Assessment, Development and Evaluation (GRADE) system (see Table 1a and b) [9], whereby recommendations are given as follows: Strong recommendations indicate that the panel is confident that the desirable effects of adherence to a recommendation outweigh the undesirable effects. Weak recommendations indicate that the desirable effects of adherence to a recommendation probably outweigh the undesirable effects, but the panel is less confident. Recommendations are based on quality of evidence: high, moderate, low and very low, but also on the balance between desirable and undesirable effects. Consistent with other ERAS® Society guidelines [10], in some cases strong recommendations may be reached from low-quality data and vice versa. The quality of evidence and recommendation strength for each item was reviewed and verified by the core guideline team (GN, PTR, and SCD). Individual search results and associated grading tables for each ERAS Gynecologic Oncology guideline item are shown in the Appendix.

3. Results

A summary of the evidence, recommendations, evidence level, and recommendation grade are provided for each individual ERAS item below and summarized in Table 2. Topics for which there was no change to the recommendation or evidence base are listed in Table 3 (nausea and vomiting prophylaxis, avoidance of drains/tubes, postoperative nutrition, prevention of postoperative ileus).

3.1. Preadmission information, education and counselling

Standardized pre-admission information, education, and counselling are important aspects of surgical care. These have been associated with improved patient outcomes including a reduction in anxiety, pain, and length of stay [11–16]. Patients have reported inconsistent approaches in the delivery of pre-operative and discharge instructions [17]. However, development of standardized scripts has been shown to improve the consistency of the information provided [18]. Evidence supporting the optimal method to provide pre-admission information, education, and counselling is mixed. A randomized controlled trial found that

Table 1
a. GRADE system for rating quality of evidence.

Evidence level	Definition
High quality	Further research unlikely to change confidence in estimate of effect
Moderate quality	Further research likely to have important impact on confidence in estimate of effect and may change the estimate
Low quality	Further research very likely to have important impact on confidence in estimate of effect and likely to change the estimate
Very low quality	Any estimate of effect is very uncertain

Table 1
b. GRADE system for rating strength of recommendations.

Recommendation strength	Definition
Strong	When desirable effects of intervention clearly outweigh the undesirable effects, or clearly do not
Weak	When trade-offs are less certain — either because of low quality evidence or because evidence suggests desirable and undesirable effects are closely balanced

inclusion of written information was associated with improved patient satisfaction and outcomes compared to verbal information alone [19]. Emerging evidence supports that some pre-admission counselling can be provided virtually, with comparable results to in-person counselling [20]. There is increasing interest in the use of artificial intelligence (AI) for patient counselling; while initial results are promising, most RCTs examining AI-assisted interventions in health care are small, single-center trials thus results should be interpreted with caution [21]. One small trial reported a statistically significant decrease in anxiety and depression in cancer patients who received pre-chemotherapy counselling from ChatGPT compared to clinician-led counselling; [22] however, expert review of the information provided by ChatGPT noted that approximately 10% of the information provided by ChatGPT was inaccurate [22]. Other work has demonstrated that steps can be taken to improve the accuracy of information provided by AI-powered chatbots and highlights that this may be necessary prior to using them to provide medical advice to patients [23]. Regardless of how pre-admission information, education, and counselling is provided, efforts should be made to ensure that patients understand the materials presented and have an opportunity to ask questions. Teach-back methods where patients and/or their family members/caregivers repeat back their understanding of the information provided and their planned actions in response to the information provided have been shown to be an effective method to ensure patient comprehension [24].

Summary and recommendation: While more evidence is needed on the optimal strategies to provide pre-admission information, education, and counselling, studies clearly show the benefits of these low-risk interventions. Thus, as part of adoption of ERAS protocols, standardized processes should be developed to ensure that all patients are provided with information about the specific procedure that will be performed, what to expect post-intervention, and how they can be actively involved in ensuring optimal outcomes.

Evidence level: Moderate.
Recommendation grade: Strong.

3.2. Prehabilitation

Prehabilitation aims to optimize the patient's physical, nutritional, and psychological status prior to surgery to enhance functional outcomes and recovery. In gynecologic oncology, multimodal prehabilitation programs have been shown to be feasible and safe [25,26] with potential preoperative and postoperative benefits [27].

Published studies indicate that structured prehabilitation in gynecologic oncology enhances preoperative functional capacity, nutritional status, and psychological wellbeing. Reported improvements in the 6-Minute Walk Test range from 20.7 m to 38.27 m above baseline, accompanied by progressive increases in daily step counts throughout the intervention period [28–30]. Gains in muscle strength and cardiorespiratory fitness have also been documented, including a 20% increase in the one repetition maximum for leg press and an 8% rise in VO₂ peak [31]. In addition, prehabilitation has been associated with an approximate 10% reduction in the prevalence of preoperative malnutrition [28,31] and a 1.2-to-5-point decrease in Hospital Anxiety and Depression Scale (HADS) scores [28–30]. However, the implications of these preoperative improvements for oncologic outcomes remain uncertain.

Table 2
Enhanced Recovery after Surgery (ERAS®) Society guidelines for gynecologic oncology: 2026 update.

Item	Recommendation	Evidence level	Recommendation grade
Preadmission information, education and counselling	Develop standardized processes to ensure all patients receive procedure-specific information, understand what to expect post-intervention, and how they can actively contribute to optimal outcomes.	Moderate	Strong
Prehabilitation	Integrate a multimodal prehabilitation program to enhance preoperative functional capacity, nutrition status, and psychological wellbeing.	Moderate	Weak
Preoperative optimization and frailty assessment			
Anemia correction	Identify the cause of anemia (often iron deficiency) and correct it preoperatively, e.g., with iron supplementation as appropriate.	High	Strong
Smoking cessation	Smoking should be stopped preoperatively; benefits appear after 4 weeks, but any smoke-free interval is likely helpful.	High	Strong
Alcohol cessation	Implement preoperative alcohol cessation with a 4–8 week abstinence target, especially in those screening positive for alcohol abuse.	Moderate	Strong
Frailty assessment	Perform frailty assessment as part of baseline evaluation for all new preoperative patients using brief screening tools, with referral of screen-positive patients for comprehensive geriatric assessment.	Moderate	Strong
Preoperative bowel preparation	When bowel prep is used and colorectal resection is anticipated, include oral antibiotic bowel preparation (OABP) plus mechanical bowel preparation (MBP). OABP alone is an alternative to OABP + MBP when colorectal resection is anticipated. Modified MBP (oral laxatives instead of osmotic prep) plus OABP is an alternative to conventional osmotic MBP plus OABP for anticipated colorectal resection. Bowel preparation regimens that include OABP should include anaerobic coverage. Do not perform bowel preparation with MBP alone. Do not use bowel preparation in benign gynecologic surgery when colorectal resection is not anticipated.	Moderate Low Moderate Moderate High High	Strong Weak Weak Strong Strong Strong
Preoperative fasting and carbohydrate treatment	Permit clear fluids until 2 h before anesthesia and surgery.	High	Strong
	Permit solids until 6 h before anesthesia and surgery.	High	Strong
	Use oral carbohydrate loading before surgery to shorten time to return of bowel function and improve patient comfort.	Moderate (GI recovery)	High
	Carbohydrate loading in well-controlled type 2 diabetes can be used but with caution.	Low	Weak
GLP-1 agonists	Hold GLP-1 agonists on the day of procedure for daily dosing, and for a week before procedure for weekly dosing; resume POD1.	Moderate	Strong
Preoperative medications	Administer NSAIDs and acetaminophen (IV or PO) preoperatively to reduce opioid requirements.	Moderate	Strong
	Gabapentin may decrease postoperative pain but should be used cautiously and limited in the elderly; there is no role for gabapentin in minimally invasive surgery.	High	Strong
	Consider duloxetine to reduce pain in minimally invasive surgery.	Moderate	Weak
VTE prophylaxis	Initiate comprehensive lower limb exercises and deep breathing postoperatively to decrease thrombosis risk.	Moderate	Strong
	Use graduated compression stockings or pneumatic compression devices combined with LMWH.	High	Strong
	Initiate pharmacologic thromboprophylaxis preoperatively (within 2 h of skin incision).	Moderate	Strong
	Continue postoperative extended prophylaxis with LMWH for 28 days after cancer laparotomy.	High	Strong
	Extended postoperative prophylaxis with DOACs can be used to reduce cost without increased bleeding risk.	High	Strong
	Limit or eliminate 28-day postoperative pharmacologic prophylaxis in MIS; use mechanical methods preferentially intraoperatively; consider medical prophylaxis only if Caprini score is high.	Moderate	Strong
	TXA may be used to decrease bleeding and transfusions without increasing VTE.	Moderate	Strong
	VTE prophylaxis can be considered during the entire course of neoadjuvant chemotherapy prior to surgery.	Low	Weak
Surgical site infection (SSI) reduction bundles			
Antimicrobial prophylaxis	Use intravenous cephalosporins plus metronidazole for clean/contaminated cases; in severe penicillin/cephalosporin allergy, consider ciprofloxacin or clindamycin with metronidazole or gentamicin.	High	Strong
Skin prep (Preop bathing)	Preoperative bathing with chlorhexidine is recommended for gynecologic laparotomy to reduce SSI.	Moderate	Strong
Skin prep (Abdominal wall)	Prepare abdominal wall with chlorhexidine-alcohol; use povidone-iodine when chlorhexidine is not available or contraindicated.	High	Strong
Vaginal prep	Use vaginal preparation with iodine or chlorhexidine solutions.	High	Strong
Normothermia (monitoring and prevention)	Monitor patient temperature intraoperatively and prevent intraoperative hypothermia.	High	Strong
Forced-air warming	Implement forced air warming preoperatively for at least 45 min prior to surgical incision.	High	Strong
Warmed IV fluids	Warmed IV fluids may be used intraoperatively to prevent hypothermia-related SSI.	Low	Strong
Ambient OR temperature	Maintain ambient OR temperature > 21.1 °C, especially combined with forced-air warming, to improve normothermia.	Low	Strong
Monitoring temperature	Continuous monitoring of core temperature intraoperatively should be performed with esophageal temperature probe to maintain normothermia.	Moderate	Strong
Wound closure (subcutaneous closure)	Routine subcutaneous closure in gynecologic laparotomy is not recommended.	Low	Strong

Table 2 (continued)

Item	Recommendation	Evidence level	Recommendation grade
Wound closure (subcutaneous drainage)	Routine subcutaneous drainage in gynecologic laparotomy is not recommended.	Moderate	Strong
Wound closure (negative pressure dressings)	Routine use of prophylactic negative pressure wound treatments is not recommended.	High	Strong
Wound closure (irrigation)	Irrigation of the wound (with povidone-iodine or alternative) should be considered as part of an SSI bundle.	Moderate	Strong
HbA1C measurement	Measure HbA1C in people scheduled for surgery based on national diabetes screening guidelines.	High	Strong
HbA1C screening	Consider HbA1C screening for people having surgery who do not meet national diabetes screening guidelines if there are additional risk factors for postoperative infections (e.g., tobacco use or previous postoperative infection).	Low	Weak
Avoidance of perioperative hyperglycemia	Treat hyperglycemia (glucose >180 mg/dL) with weight-based correction-dose insulin in patients with and without diabetes.	Moderate	Strong
Standard anesthetic protocol			
Short-acting agents and NMB monitoring	Use short-acting anesthetics, objectively monitor neuromuscular block depth, and ensure complete reversal.	Low (short-acting) High (monitoring)	Strong Strong
Protective ventilation	Use lung-protective ventilation (e.g., tidal volume 6–8 mL/kg, moderate PEEP).	Moderate	Strong
Multimodal analgesia and regional techniques	Use perioperative multimodal analgesia (non-opioid oral meds plus incisional local anesthetic or fascial plane blocks such as quadratus lumborum, TAP, erector spinae) to reduce systemic opioid use.	High (multimodal, acetaminophen+NSAID, incisional bupivacaine)	Strong
		Moderate (quadratus lumborum block)	Strong
		Low (TAP and erector spinae blocks)	Strong
Goal-directed fluid therapy (GDFT)	Use perioperative GDFT to reduce hospital length of stay and complications in major gynecologic oncology surgery.	High	Strong
Minimally invasive surgery (MIS)	Use MIS for uterine-confined endometrial cancer and laparotomy for operable cervical cancer, combined with ERAS, to optimize recovery	High	Strong
	Align ERAS pathway utilization with the surgical approach that best supports oncologic goals in patients at risk for or diagnosed with ovarian cancer.	High	Strong
	Prioritize 5 mm instead of 11 mm primary trocar and intracorporeal rather than transvaginal colpotomy closure to reduce postoperative pain and cuff complications.	Moderate	Strong
	Modify MIS ERAS protocols (e.g., omission of passive voiding trials) to improve same-day discharge metrics.	High	Strong
Opioid sparing postoperative analgesia	Use restrictive (1–5 tablets) or no-opioid discharge prescriptions for most patients.	High	Strong
	Continue buprenorphine perioperatively in patients with opioid use disorder.	High	Strong
	Consider buprenorphine instead of full opioid agonists for postoperative pain.	Moderate	Weak
	Suzetrigine may be used instead of full opioid agonists for postoperative pain (taking cost into account).	Moderate	Weak
Urinary drainage			
Routine cases	Remove indwelling bladder catheters as early as possible (same day for MIS, no later than POD1 for laparotomy, including radical hysterectomy), unless contraindicated.	Moderate	Strong
Bladder/ureter injuries	Maintain urinary catheters for 7 days after elective/traumatic cystotomy or cystectomy; irradiated patients or complex ureteral reconstructions may need 2–4 weeks; obtain cystogram before removal in complex repairs.	Low	Strong
Early mobilization	Encourage patients to mobilize within 24 h of surgery; ensure nursing/allied health resources to support this.	Low	Strong
Discharge pathways	Provide clear, understandable discharge information; use digital tools/apps when possible, to improve adherence to instructions and early complication detection.	Low	Strong
Audit and reporting	Use audit and feedback to monitor and report compliance with each ERAS component.	Moderate	Strong
	Aim for ≥80% overall ERAS protocol compliance, as higher compliance correlates with improved outcomes (shorter LOS, fewer complications/readmissions).	Moderate	Strong

Regarding intraoperative and postoperative outcomes, prehabilitation has been associated with a reduction in intraoperative blood transfusion (14.3% vs. 53.3%), postoperative complications (53% vs 79%), length of hospital stay (5.0 vs. 7.0 days) and time to initiation of adjuvant chemotherapy (25 vs. 35 days). However, these data are derived from small pilot feasibility studies [32,33].

Emerging data suggest that multimodal prehabilitation is feasible, safe and may optimize preoperative functional status, as well as support postoperative recovery in gynecologic oncology patients. However, the current evidence is limited by small sample sizes, heterogenous interventions, and a lack of high-quality randomized controlled trials. Larger

studies are needed to determine which patient populations benefit most from specific interventions and to confirm any improvements in clinical outcomes.

Summary and recommendation: The integration of a multimodal prehabilitation program is suggested to enhance preoperative functional capacity, nutrition status and psychological wellbeing. Further data are needed to determine the overall impact and to identify the most effective interventions.

Evidence level: Moderate.

Recommendation Grade: Weak.

Table 3

ERAS items not updated in 2026 guideline (no change in recommendation/evidence).

Item	Recommendation	Evidence level	Recommendation grade
Nausea and vomiting prophylaxis	A multimodal approach to post-operative nausea and vomiting with >2 antiemetic agents should be used for patients undergoing gynecologic oncology surgery.	Moderate	Strong
Avoidance of drains/tubes	The use of peritoneal drains and nasogastric tubes should be avoided after abdominal surgery.	High	Strong
Postoperative nutrition	A regular diet within the first 24 h after gynecologic oncology surgery is recommended (including for patients undergoing bowel resection).	High	Strong
Prevention of postoperative ileus	Coffee consumption and gum chewing are effective in decreasing the time to bowel function, as well as ERAS components such as euolemia, early feeding and early mobilization.	High	Strong

3.3. Preoperative optimization and frailty assessment

Patients with co-morbidities, such as cardiovascular or pulmonary disease, should undergo specialty consultation to ensure safe perioperative planning. Optimization should also address anemia, smoking, and alcohol abuse. The benefits of medical optimization must be balanced with the surgical urgency, particularly interventions expected to result in long surgical delays.

3.3.1. Anemia

Pre-operative anemia is common and associated with morbidity and mortality in the surgical patient [34]. Specifically in gynecologic oncology, pre-operative anemia is seen in about a quarter of patients, and associated with higher risk of infectious complications, need for transfusion, and thrombosis, even after correcting for confounders such as stage and surgical complexity [35]. Patient blood management programs seek to improve pre-operative anemia to improve clinical outcomes and to decrease the utilization of blood transfusion [36]. Understanding the cause of anemia is essential, especially to identify easily correctable causes such as iron-deficiency. Supplementation with iron is recommended prior to elective surgery in those patients with iron-deficiency anemia; the method of supplementation is dependent on the degree of anemia and time to surgery [36]. Patient blood management programs have been successful in increasing pre-operative hemoglobin and reducing blood transfusion in gynecologic oncology. However, there remains an absence of evidence for peri-operative or survival benefits [36–38].

3.3.2. Alcohol, tobacco use

Smoking is associated with pulmonary and almost all major surgical complications including wound dehiscence, anastomotic complication and thromboembolic events [39–41]. Efforts to minimize or stop smoking, even for 4 weeks prior to surgery can improve outcomes [40–44], but data suggest longer may have even more improvements. Intensive perioperative alcohol cessation 4–8 weeks before surgery in risky drinkers (defined as >3 alcohol units/day or > 21 units/week; 1 unit = 12 g ethanol) reduces postoperative complications (RR 0.62, 95% CI 0.40–0.96) across three Danish RCTs ($n = 140$); mortality data are inconclusive [45]. Screening for unhealthy excessive alcohol use and potential alcohol withdrawal is an important part of pre-operative assessment.

Summary and recommendation: All surgical patients need optimization of medical co-morbidities in collaboration with medical specialties and anesthesia. Anemia is common and frequently due to iron deficiency. Identifying the cause of anemia and correcting it should occur pre-operatively. Smoking is associated with postoperative morbidity and should be stopped pre-operatively, however the optimal smoke-free interval is not clear. It appears benefits occur after 4 weeks, but any time without smoking may be helpful. Implement preoperative alcohol cessation with a 4–8 week abstinence target, especially for those screening positive for alcohol abuse.

Evidence Level:

Anemia: High.

Tobacco: High.

Alcohol: Moderate.

Recommendation grade:

Anemia: Strong.

Tobacco: Strong.

Alcohol: Strong.

3.3.3. Frailty assessment

Frailty is a clinical syndrome marked by reduced resilience to the stress of disease and its treatment. It can be assessed prospectively using multidimensional tools based on patient report or direct physical function testing, although most gynecologic oncology data are retrospective [46]. Across multiple studies, frailty is associated with increased morbidity, prolonged hospitalization, higher postoperative mortality, and greater health care utilization, regardless of the assessment method used [47–51].

There is no consensus on the optimal tool for routine clinical use, but several options can be integrated into practice. The simplest are frailty indices, such as the deficit accumulation index and the Fried phenotypic frailty index, which are brief inventories of comorbidities and functional status [52,53]. Although easily derived, these tools have important limitations and are probably better suited to research than routine care. Direct physical performance tests, including the Timed Up and Go (TUG) and the Five Times Sit-to-Stand test (FTSST), can be administered quickly in clinic [54,55], but they measure specific physical parameters, are not validated in surgical oncology, and are likely insufficient to identify preoperative frailty on their own. More comprehensive approaches, such as the comprehensive geriatric assessment, evaluate multiple domains but are challenging to implement in busy clinics [56].

Given these barriers, a pragmatic strategy is stepwise screening. Brief tools such as the FRAIL scale or G8 questionnaire (both self-administered) or the Edmonton Frail Scale can be used for rapid preoperative screening. Patients who screen positive can then be referred for a formal comprehensive geriatric assessment in specialized care.

Summary and recommendation: Frailty assessment is recommended as part of the baseline evaluation for all new preoperative patients, using brief screening tools with referral of screen-positive patients for comprehensive geriatric assessment.

Evidence level: Moderate.

Recommendation grade: Strong.

3.4. Preoperative bowel preparation

Since the 2019 update of the Enhanced Recovery After Surgery (ERAS) guidelines, a growing body of evidence has emerged evaluating the role of preoperative bowel preparation in both benign gynecologic surgery and open gynecologic oncology procedures involving colorectal resection. Additionally, high level data generated through randomized

controlled trials in elective colorectal surgery and meta-analyses of the collective studies on preoperative bowel preparation has grown, leading to opportunities to extrapolate to gynecologic cancer surgery requiring colorectal resection.

The benefit of preoperative bowel preparation appears to be predominantly associated with the addition of oral antibiotic bowel preparation (OABP) with similar surgical site infection (SSI) reduction rates noted in ovarian cancer cytoreduction with bowel resection when comparing OABP alone versus OABP plus mechanical bowel preparation (MBP) [57,58] and in colorectal resections with OABP alone versus OABP plus MBP [59–61]. Within large retrospective ovarian cancer debulking studies, OABP plus MBP in the setting of bowel resection appears to be associated with decreases in deep incisional and organ/space SSI, diverting ostomy use, readmissions, and length of hospital stay [57,58]. However, OABP plus MBP was also associated with higher risk of ICU admission and more severe cardiac and GI complications [58]. In the setting of elective colorectal resection for colorectal pathology, randomized controlled trials and meta-analyses overarchingly support a combination of OABP plus MBP in providing the greatest benefit in reducing SSI, anastomotic leak (AL), and other postoperative complications such as ileus, reoperation, readmission and mortality. Specifically, the addition of OABP to MBP appears to reduce the risk of SSIs by 30–84% [57–59,62–73], AL by 40–70% [60,65,70,72–75], and significantly reduces rates of ileus, reoperation, readmission, mortality [66,73] and overall complications [65].

Additional considerations that have been identified through studies in colorectal surgery include the importance of anaerobic coverage when using OABP, with a 75% lower SSI rate noted when anaerobes are covered compared to no anaerobic coverage [64] and that the use of OABP does not appear to increase *Clostridium difficile* risk [67,76]. There is also RCT-derived data suggesting a modified MBP with oral laxatives plus OABP is non-inferior to conventional osmotic MBP plus OABP in SSI rates and patients better tolerated modified MBP [77].

Importantly, in colorectal resections MBP alone does not appear to improve SSI, AL, reoperation, or mortality rates [78–80] and there is one prospective observational study in colorectal surgery that suggests a nearly 4-fold higher AL rate when OABP alone was utilized [74]. Higher level evidence remains needed in the setting of elective colorectal resection to determine the optimal bowel preparation in such settings. Notably, a four-arm RCT (NCT03663504) leveraging the REthinking Clinical Trials (REACT) platform and National Surgical Quality Improvement Program (NSQIP) comparing OABP alone, MBP alone, OABP plus MBP, and no bowel preparation on SSI rates in elective colorectal surgery is currently underway and expected to be completed in July 2026 [81].

In benign gynecologic surgery without bowel resection, recently published randomized controlled trials assessing the impact of MBP on intraoperative pelvic visualization and bowel handling during minimally invasive surgery demonstrated no difference with MBP compared to 24-h preoperative liquid diet [82,83] or 3-day preoperative minimal residual diet [83], including in patients with higher BMIs [84]. However, there were higher rates of patient gastrointestinal (GI) discomfort associated with MBP [82,83]. Collectively, these randomized controlled trials demonstrate that routine MBP does not improve ease of surgery in benign gynecologic cases but is a patient dissatisfier and should be abandoned in this surgical setting.

In summary, when a colorectal resection is anticipated, OABP plus MBP is associated with reduced rates of SSIs, AL, and other postoperative complications. Additionally, there is strong evidence against using bowel preparation in gynecologic surgery when a colorectal resection is not planned. OABP plus MBP, as well as alternative bowel preparation strategies, remain under study in colorectal surgery.

Summary and recommendations:

When colorectal resection is anticipated as part of gynecologic surgery and bowel preparation is utilized, bowel preparation should include OABP plus MBP.

Evidence level: Moderate.

Recommendation grade: Strong.

Bowel preparation with OABP alone in the setting of anticipated colorectal resection is an alternative to OABP plus MBP.

Evidence level: Low.

Recommendation grade: Weak.

Modified MBP (oral laxatives instead of osmotic preparation) plus OABP is an alternative to conventional MBP (osmotic preparation) plus OABP in the setting of anticipated colorectal resection.

Evidence level: Moderate.

Recommendation grade: Weak.

Bowel preparation regimens that include OABP should include anaerobic coverage.

Evidence level: Moderate.

Recommendation grade: Strong.

Bowel preparation should not be performed with MBP alone.

Evidence level: High.

Recommendation grade: Strong.

Bowel preparation should not be used in benign gynecologic surgery when a colorectal resection is not anticipated.

Evidence level: High.

Recommendation grade: Strong.

3.5. Preoperative fasting and carbohydrate treatment

High glycemic variability is associated with longer post-operative lengths of stay and increased short-term and long-term mortality [85, 86]. ERAS protocols promote minimization of fasting times and recommend a preoperative complex carbohydrate load between 2 and 3 h prior to surgery to minimize glycemic variability. While carbohydrate loading shortens length of stay, the evidence indicating that reduction in insulin resistance as the primary mechanism for this effect is not consistent [87]. Even so, studies have consistently demonstrated that carbohydrate loading is associated with earlier recovery of gastrointestinal function and improved patient comfort [88–90]. Combining carbohydrate loading with early feeding further improves gastrointestinal recovery times and shortens length of stay [91].

The optimal volume of carbohydrate solution remains uncertain, but the most recent American Society of Anesthesiologists guidelines permit up to 400 mL within 2 h of surgery [92]. Complex carbohydrate solutions with starches such as maltodextrin are preferable, as they reduce glycemic variability better than simple sugar solutions like sports drinks or fruit juices [93–95]. While initial ERAS protocols described a two-dose regimen (800 mL with 100 g maltodextrin the evening before surgery and 400 mL with 50 g maltodextrin 2–3 h before anesthesia induction), given the effects of carbohydrate loading last about 6 h, the benefit of an evening dose is unclear. No studies have compared one vs. two-dose regimens. However, mechanistically, the morning dose (2 h pre-induction) is the more physiologically important dose, as it is the one that directly transitions the patient from fasting to fed state at the time of surgery.

Whether carbohydrate loading is safe in diabetic patients remains controversial [96]. There does not appear to be a difference in gastric emptying times or glycemic variability between patients with and without diabetes receiving a carbohydrate load [97–99]. Randomized clinical trials in bariatric surgery patients indicate no differences in glycemic control or aspiration risk between those with and without diabetes [100,101].

Glucagon-like peptide-1 (GLP-1) receptor agonists, which are known to slow gastric-emptying, have become increasingly common in gynecologic oncology patients, raising concerns about fasting times. Both a meta-analysis of nine studies involving 185,414 patients and a claims database review of 392,065 surgical patients found no association between GLP-1 use and perioperative pulmonary aspiration [102, 103]. While there is no high-level evidence to inform the optimal duration of fasting for patients on GLP-1 agonists, a meta-analysis of studies using gastric emptying scintigraphy found that the mean difference in gastric emptying with GLP-1 agonists was only 36 min [104,105]. Even

so, in line with guidance from the American Society of Anesthesiologists, and reaffirmed by a multi-society consensus panel, we recommend holding GLP-1 agonists on the day of the procedure for patients on daily dosing and for a week prior to the procedure for patients on weekly dosing, irrespective of whether the GLP-1 agonist is prescribed for type 2 diabetes or weight loss [106,107]. After that, patients on GLP-1 agonists can be similarly managed in terms of fasting. GLP-1 agonists can be resumed on post-operative day 1.

Summary and recommendations:

Patients should be permitted to drink clear fluids until 2 h before anesthesia and surgery.

Patients should abstain from solids 6 h prior to induction of anesthesia.

Oral carbohydrate loading is recommended before surgery to shorten time to return of bowel function and improve patient comfort.

GLP-1 agonists should be held on the day of the procedure for patients on daily dosing and for a week prior to the procedure for patients on weekly dosing.

Evidence level:

Safety of fasting times for solids and fluids: High.

Carbohydrate loading improves patient comfort: High.

Carbohydrate loading promotes recovery of GI function: Moderate.

Beneficial effects of carbohydrate loading occur primarily via insulin resistance: Low.

Carbohydrate loading, safety in people with diabetes: Low.

Cessation of GLP-agonists preoperatively: Moderate.

Recommendation grade:

Fasting guidelines: Strong.

Carbohydrate loading (general): Strong.

Cessation of GLP-agonists preoperatively: Strong.

Carbohydrate loading in well-controlled Type 2 Diabetes: Weak.

3.6. Preoperative medications

Preoperative medications in gynecologic surgery should be aimed at decreasing pain and anxiety. Consistent with previous ERAS guidelines, anxiolytics may be used in certain cases but should not be considered routine and should be avoided within 12 h of surgery [5,8]. Gabapentinoids have been examined in several meta-analyses, in gynecologic [108] and bariatric surgery [109], and a randomized trial in inguinal hernia repair [110], showing a decrease in postoperative pain. Gabapentin, however, remains cautionary for use in elderly patients due to effects related to sedation, delirium and pneumonia [8,111]. Preoperative use of gabapentin in minimally invasive gynecologic procedures has been examined in one RCT and has shown no benefit in decreasing pain [112]. Although there remains limited evidence for the use of preoperative acetaminophen, there is support in the colorectal literature [108] and should be considered in the preoperative setting unless the patient has obvious contraindications; studies examining acetaminophen have administered this medication orally, IV and rectally. A single site unblinded randomized controlled trial of 76 patients in minimally invasive gynecology (v-notes) examined the use of duloxetine (60 mg orally) preoperatively and repeated postoperatively (24 h); they found a decrease in multi-assessment pain scores, decreased rescue analgesic use and increased QoL scores [113].

Summary and recommendations: Preoperative administration of NSAIDs and acetaminophen (IV or po) is recommended with the aim of reducing opioid requirements. Gabapentin may aid in decreasing postoperative pain scores, but use should be cautionary and limited in the elderly population. There is no role for gabapentin in minimally invasive surgical procedures. Consideration may be made for duloxetine in minimally invasive gynecologic surgery.

Preoperative administration of NSAIDs and Acetaminophen.

Evidence level: Moderate.

Recommendation grade: Strong.

Limit Gabapentin use in the elderly and in minimally invasive surgery.

Evidence level: High.

Recommendation grade: Strong.

Duloxetine for minimally invasive gynecologic surgery.

Evidence level: Moderate.

Recommendation grade: Weak.

3.7. Venous thromboembolism prophylaxis

Venous thromboembolism (VTE) prophylaxis should be initiated prior to surgery (within 2 h from skin incision), combined with mechanical methods (graduated compression stockings (GCS) or sequential compression devices (SCD) [7,8,114,115] and continue for 28 days postoperatively in open gynecologic oncology cases [5,7,8]. New information suggest that active exercises of the lower limbs and deep breathing may result in reduced rates of thrombosis [116] and is a cost effective and non-invasive strategy. Meta-analysis has also examined the rates of VTE in the neoadjuvant chemotherapy (NAC) population; with a VTE rate of 10%, prophylaxis may be considered in the NAC setting and prior to surgery [117].

Direct oral anticoagulant (DOAC) use for postoperative prophylaxis has been examined in a RCT in gynecologic oncology showing no difference in bleeding or VTE rates, with a significant improvement in patient satisfaction when apixaban was compared to enoxaparin [118]; rates of VTE were likely too low to see a difference in this study [1.0% apixaban vs 1.5% enoxaparin (OR 1.57; 95%CI, 0.26–9.50; $P = 0.68$)]. Information from trials of DOAC versus low molecular weight heparin (LMWH) for the treatment of VTE in patients having surgery for cancer (gynecologic, colorectal and lung) have shown equivalence [119] with one meta-analysis in major abdominopelvic cancer surgery showing a slight decreased rate of VTE with DOACs [115]. Prophylaxis with DOACs is cost effective for prevention of DVT, with no difference in cost for pulmonary embolisms (PE) [120]. Recognizing the very low rates of VTE in minimally invasive surgery (MIS), intraoperative and extended prophylaxis should be used only for high-risk patients, with mechanical prophylaxis being the preferred modality [8,121,122]. The authors concluded that the Caprini score for endometrial cancer patients overestimates the risk of VTE for MIS, however no other model appears to function better; given these limitations, high risk Caprini score can be used to consider medical prophylaxis. Tranexamic Acid (TXA) use was examined in a meta-analysis in multiple cancer surgeries showing a decreased rate of blood loss and blood transfusions, without a subsequent increase in the rate of VTE [123].

Summary and recommendations:

VTE prophylaxis should be initiated preoperatively and consist of anticoagulants (administered within 2 h from skin incision) and mechanical methods. Functional exercise and deep breathing should be initiated after surgery, as well as extended prophylaxis for cancer laparotomies for 28 days with either LMWH or a DOAC. Anticoagulation can be considered in the neoadjuvant setting during the entire course of chemotherapy treatment. TXA may be used to control bleeding and decrease transfusions without an increased rate of VTE. Due to low rates of VTE in MIS patients, intraoperative and extended medical prophylaxis is not routinely recommended, and mechanical prophylaxis is preferred; medical prophylaxis can be considered if Caprini score is high.

Comprehensive functional exercises of the lower limbs and deep breathing may result in decreased rates of thrombosis.

Evidence level: Moderate.

Recommendation grade: Strong.

Graduated compression stockings or pneumatic compression devices combined with LMWH.

Evidence level: High.

Recommendation grade: Strong.

Preoperative administration of thromboprophylaxis.

Evidence level: Moderate.
 Recommendation grade: Strong.
 Postoperative extended prophylaxis with LMWH (28 days).
 Evidence level: High.
 Recommendation grade: Strong.
 Postoperative extended prophylaxis with DOACs to reduce cost without an increased risk of bleeding.
 Evidence level: High.
 Recommendation grade: Strong.
 Limit or eliminate 28-day postoperative prophylaxis in MIS and preferentially use mechanical methods alone intraoperatively.
 Evidence level: Moderate.
 Recommendation grade: Strong.
 TXA may be used to decrease the risk of bleeding and blood transfusion with no effect of rates of VTE.
 Evidence level: Moderate.
 Recommendation grade: Strong.
 VTE prophylaxis can be used in the neoadjuvant setting during the course of chemotherapy prior to surgery.
 Evidence level: Low.
 Recommendation strength: Weak.

3.8. Surgical site infection (SSI) reduction bundles

A review of recent data confirms that adherence to ERAS guidelines and implementation of surgical site infection (SSI) reduction bundles decrease rates of SSI [7,124–127]. SSI prevention bundles include multiple aspects of care that span the perioperative period. These bundles typically include standardized antimicrobial prophylaxis, skin preparation, avoidance of perioperative hyperglycemia, prevention of hypothermia and wound closure techniques [7].

3.8.1. Antimicrobial prophylaxis

A combination of intravenous cephalosporins and metronidazole should be used for clean-contaminated surgical cases [128–131]. Vaginal metronidazole should be avoided as vaginal administration is not effective in preventing SSI [132]. Only patients with severe cutaneous penicillin allergies or proven allergies to cephalosporins or metronidazole are recommended to use alternative antibiotic agents as the risk of cross reactivity of cephalosporins for patients with less severe penicillin allergies is 0.7% and use of alternative agents instead of cephalosporins is associated with higher rates of SSI [133–135]. Risk stratification tools such as PEN-FAST [136] quantify the risk of severe allergic reaction to penicillin or related antibiotics and can identify which patients receive alternative antibiotic regimens of ciprofloxacin or clindamycin with metronidazole or gentamicin [130,131].

Summary and recommendation:

Preoperative antibiotic prophylaxis should include both intravenous cephalosporins and metronidazole for clean/contaminated cases unless a patient has a proven severe allergy to penicillin or cephalosporins; for these patients ciprofloxacin or clindamycin with metronidazole or gentamicin should be considered.

Evidence level: High.

Recommendation grade: Strong.

3.8.2. Skin preparation

Skin preparation aims to decrease bacterial colonization of the surgical site. This is achieved through preoperative bathing at home, as well as site preparation in the surgical theatre.

Preoperative bathing: Proper timing and usage of chlorhexidine (soap or wipes) can create a sustained concentration of chlorhexidine on the skin that is sufficient to kill and inhibit pathogens at the surgical site. There is limited evidence of the clinical effect of this intervention in gynecologic oncology, but this intervention as part of SSI bundles has successfully decreased rates of SSI in gynecologic oncology [125,137,138].

Surgical site preparation: Recent meta-analyses of randomized trials have provided conflicting evidence regarding the superiority of chlorhexidine-alcohol preparations compared to povidone-iodine in reducing SSI [139,140]. One large (17,735 patients) network meta-analysis of RCTs reported the superiority of chlorhexidine over aqueous iodine in all surgery types (relative risk 0.75, 95% CI 0.61–0.92) [139]. Another meta-analysis which focused on only high quality/low risk of bias studies on abdominal surgeries did not demonstrate a significant benefit of chlorhexidine over iodine [140]; this study included only contemporary, randomized controlled trials encompassing Caesarean section [141], laparoscopic hysterectomy [142], and abdominal surgeries [143,144]. Although a large propensity score-matched retrospective study demonstrated a reduction in the odds of SSI in benign open gynecology (OR 0.31, 95% CI 0.17–5.6, $P=0.001$) [145], an RCT in gynecologic oncology laparotomies found no difference in SSI rates between chlorhexidine-alcohol and povidone iodine [146]. Given these findings, chlorhexidine-alcohol solutions or povidone-iodine may be reasonable for surgical skin preparation, however further high-quality studies on gynecologic oncology patients are needed.

Vaginal preparation: There are few large, randomized studies addressing rates of SSI with various vaginal preparations. A recent meta-analysis of vaginal preparation at time of hysterectomy included 10 studies (9618 participants) but only included 4 randomized controlled trials (306 participants); this study found no difference in surgical site infections between povidone-iodine compared to chlorhexidine gluconate (OR 1.22 95% CI 0.91–1.63). Positive vaginal cultures were less common with chlorhexidine gluconate compared to povidone iodine (OR 0.10 95% CI 0.04–0.27), however two cases described serious adverse events with chlorhexidine gluconate, and none with povidone iodine [147]. Chlorhexidine is not FDA approved for vaginal preparation; however its use is considered safe by the American College of Obstetricians and Gynecologists [130].

Summary and recommendations:

Preoperative bathing with chlorhexidine is recommended for gynecologic laparotomy to reduce risk of SSI.

Evidence level: Moderate.

Recommendation grade: Strong.

Abdominal wall preparation with chlorhexidine-alcohol or povidone-iodine (when chlorhexidine is not available or is contraindicated) are recommended to decrease the risk of SSI.

Evidence level: High.

Recommendation grade: Strong.

Vaginal preparation with iodine or chlorhexidine solutions are recommended.

Evidence level: High.

Recommendation grade: Strong.

3.8.3. Prevention of hypothermia

Numerous studies have demonstrated the deleterious effect of hypothermia on SSI rates [148,149]. Recent meta-analyses support the practice of prevention of hypothermia during surgery to prevent SSI [150].

Forced air warming:

A recent systematic review concluded that forced air warming has a beneficial effect on surgical site infection and complication rates in those undergoing abdominal surgery (RR 0.36 95% CI 0.20 to 0.66) [148]. Hypothermia prevention should start in the preoperative setting; Fossum and colleagues demonstrated that prewarming with forced air warmers for a minimum of 45 min in the preoperative holding area led to higher patient temperatures following the surgery than those warmed with only cotton blankets [151].

Intravenous warming:

Limited data exist to inform the decision to use warmed intravenous fluids specifically to prevent surgical site infection. Warmed intravenous fluids have been found to be effective in reducing hypothermia, and preventing temperature drop at time of elective surgery [152] on their own, or in combination with force air warmers (in Caesarean

section) [153]. Unfortunately, none of the studies in these meta-analyses looked at the effect of warmed IV fluids on surgical site infection rates. Furthermore, studies on warmed IV fluid alone were not included in the meta-analysis by Madrid et al. which demonstrated reduction in SSI [148].

Ambient temperature:

A quality improvement study in gynecologic surgery found that increasing the ambient OR temperature during and between cases to (74F/23.3 °C) improved rates of patient normothermia (>36.0 °C) from 68% historically to 79% post intervention. This intervention had the side effect of decreasing OR staff comfort. They found that the subsequent pre-warming of patients with forced air warmers prior to and during entry into the OR allowed lower intraoperative ambient temperature (70F/21.1 °C) resulting in improved staff comfort without a deleterious effect on normothermia rates [154].

Monitoring of temperature:

Pulmonary artery catheterization is the gold standard for core temperature monitoring however, this method is invasive and carries risk of infection and tissue damage [155,156]. Surrogate measures of core temperature include esophageal probes, nasopharyngeal and oropharyngeal probes, and bladder probes [155]. Esophageal probes are both safe and accurate during the intraoperative period [155,156]. Bladder probes are accurate, but measurements may lag when urine output is low [156]. Nasopharyngeal and oropharyngeal probes are dependent on probe position for accuracy [155]. Monitoring of temperature with aural canal and temporal cutaneous infrared devices provides only an estimate of core temperature but is tolerable for patients in the pre and post anesthetic period and should be performed every 15 min [154]. Zero-heat-flux thermometry is a non-invasive technology that allows measurement (as opposed to an estimate) of core temperature through the skin surface. A recent meta-analysis on this technology over 16 studies and 952 patients demonstrated that it could deviate as much as 1 °C higher or lower (95% Limit of agreement −0.95 °C to 0.98 °C) than core temperature [155].

Summary and recommendations:

Patient temperature should be monitored intraoperatively, and intraoperative hypothermia should be prevented.

Evidence level: High.

Recommendation grade: Strong.

Forced air warming should be implemented preoperatively for at least 45 min prior to surgical incision.

Evidence level: High.

Recommendation grade: Strong.

Warmed intravenous fluids may be used intraoperatively to prevent surgical site infection due to hypothermia.

Evidence level: Low.

Recommendation: Strong.

Maintenance of ambient OR temperature (>21.1 °C) (especially in combination with forced air warming) can improve rates of normothermia.

Evidence level: Low.

Recommendation: Strong.

Continuous monitoring of core temperature intraoperatively should be performed with esophageal temperature probe to maintain normothermia.

Evidence level: Moderate.

Recommendation: Strong.

3.8.4. Wound closure techniques

Laparotomy closure and drainage: There is conflicting evidence on the necessity of closure of subcutaneous tissue at the time of laparotomy. A Cochrane review of 815 patients in 6 trials of non-Caesarean laparotomies demonstrated that there was no significant reduction in surgical site infection rates with subcutaneous closure compared to non-closure [157]. A recent meta-analysis of 10 studies including 3696 patients undergoing Caesarean section supports the practice of

subcutaneous closure to reduce any wound complication (OR 0.66 95% CI 0.47–0.93) and seroma formation (OR 0.53 95% CI 0.33–0.84), however there was no demonstrated improvement in surgical site infection between subcutaneous closure and non-closure (OR 0.99 95% CI 0.70–1.41) [158].

Although subcutaneous drains have been recommended to prevent lymphocyst formation in inguofemoral lymph node dissection, they are associated with increased rates of cellulitis [159]. Subcutaneous drainage in gynecologic oncology laparotomy has not been extensively studied. Although there is evidence supporting this practice in colorectal and GI surgery to prevent SSI, many of the studies in this population were done prior to the implementation of modern incision closure practices [160]. Choi and colleagues reported no significant difference in SSI rate with the addition of a subcutaneous drain compared to no closed drainage in their exploratory analysis in gynecologic oncology patient; the patients in this study had low BMI and underwent subcutaneous closure [161]. The use of subcutaneous drains cannot be universally recommended in the gynecologic oncology population.

Prophylactic intraoperative incisional wound irrigation is thought to decrease surgical site infection by decreasing debris, metabolic waste, and microbially contaminated exudate in the wound prior to closure. A recent network meta-analysis demonstrated that irrigation with antiseptic solutions (iodine) can reduce the rate of SSI. The authors caution against the use of routine antibiotic wound irrigation due to the risk of antimicrobial resistance and inferior evidence for efficacy [162].

Closure of the skin can be achieved with either skin staples or subcuticular suture. Kuroki and colleagues demonstrated that suture closure does not reduce surgical site complications (including surgical site infection) compared to staple closure in obese (BMI >30 kg/m²) gynecology patients undergoing midline laparotomy [163].

A randomized controlled trial in gynecology patients undergoing laparotomy demonstrated similar rates of surgical site infection, wound separation, seroma, and hematoma between superficial (closed wound) negative pressure dressings compared to standard gauze dressings. This study did demonstrate an increase in skin blistering with negative pressure dressings [164]. A recent meta-analysis of 5 studies undergoing laparotomy for gynecologic cancer demonstrated no statistically significant improvement in SSI rates with the use of prophylactic negative pressure dressings (OR 0.40 95% CI 0.15–1.10) [165]. This meta-analysis included the RCT by Leitao and colleagues and the trend towards reduction in SSI was driven by non-randomized retrospective studies.

Routine subcutaneous closure in gynecologic laparotomy is not recommended.

Evidence level: Low.

Recommendation grade: Strong.

Routine subcutaneous drainage in gynecologic laparotomy is not recommended.

Evidence level: Moderate.

Recommendation grade: Strong.

Routine use of negative pressure wound treatments is not recommended.

Evidence level: High.

Recommendation grade: Strong.

Irrigation of the wound (with povidone iodine, or other alternative) should be considered as part of an SSI bundle.

Evidence level: Moderate.

Recommendation grade: Strong.

3.8.5. Avoidance of perioperative hyperglycemia

Hyperglycemia (glucose >180 mg/dL) on the day of surgery and in the immediate postoperative period is a modifiable risk factor for SSI [166,167], readmissions [168], and 30-day mortality [169] in patients with and without diabetes. Patients who meet diabetes screening guidelines (those older than 35 years in the US or older than 40 years in Canada and anyone with risk factors such as being overweight,

having a relative with diabetes, or having hypertension) should have a hemoglobin A1C measured before surgery to characterize their risk of perioperative hyperglycemia and other complications.

While an elevated HbA1C is associated with increased infections, adverse events, and 30-day mortality [169], these risks are reduced when adjusting for postoperative hyperglycemia. Further, some observational data suggests that people with higher HbA1C have better outcomes than people with prediabetes or at-target HbA1Cs, likely due in part to increased treatment of perioperative hyperglycemia in people with higher HbA1Cs [168]. It is not clear whether elective surgery should be cancelled or postponed based on HbA1C values and there is no strict HbA1C cut-off that determines unacceptable surgical risk. It is reasonable to cancel surgery for people who present with decompensated diabetes, defined by symptoms of hyperglycemia such as polyuria, polydipsia, weight loss, and acidosis.

Observational data suggests that people without diabetes who have hyperglycemia may have worse outcomes than people with diabetes at the same level of hyperglycemia, though these studies have high potential for confounding [170,171]. Observational and pre/post-intervention data suggests that treatment of hyperglycemia with weight-based correction dose insulin reduces occurrence of adverse postoperative outcomes including SSI and re-admissions in people with and without diabetes [166–168,171].

Summary and recommendations:

Measure HbA1C in people scheduled for surgery based on national diabetes screening guidelines.

Evidence level: High.

Recommendation grade: Strong.

Consider HbA1C screening for people having surgery who do not meet national diabetes screening guidelines if there are additional risk factors for postoperative infections such as tobacco use or previous postoperative infection.

Evidence level: Low.

Recommendation grade: Weak.

Treat hyperglycemia (glucose >180 mg/dL) with weight-based correction dose insulin in people with and without diabetes.

Evidence level: Moderate.

Recommendation grade: Strong.

3.9. Standard anesthetic protocol

Anesthetic management in gynecologic oncologic surgery should be standardized to minimize physiological disturbances, mitigate the surgical stress response, incorporate multimodal opioid-sparing analgesia, promote functional recovery, and reduce length of stay [7]. Short-acting anesthetics, multimodal analgesia, opioid-sparing strategies such as regional anesthesia, lung-protective ventilation, maintenance of normothermia, and optimal fluid management aimed at a zero-balance or goal-directed fluid therapy using hemodynamic monitoring tools to track real-time dynamic indices and trends of flow and perfusion are recommended when feasible, especially for open or lengthy procedures in high-risk patients [172,173].

Intraoperative multimodal analgesia with acetaminophen and non-steroidal anti-inflammatory drugs, gabapentinoids, and selective intravenous adjuncts such as low-dose ketamine, dexmedetomidine, or magnesium aims to minimize perioperative opioid consumption [174]. A recent meta-analysis of major abdominal cancer surgery showed that intravenous lidocaine infusion improved postoperative pain control, reduced opioid requirements, and enhanced gastrointestinal recovery [175].

Regional anesthesia remains a vital component of enhanced recovery after surgery (ERAS) pathways. Recent evidence suggests that the benefits of the transversus abdominis plane (TAP) block may be more limited than previously believed [176,177]. Disadvantages of the TAP block include its ineffectiveness for visceral pain and the need for a bilateral block for midline incisions [176]. A recent meta-analysis

concluded that evidence does not support the benefit of TAP blocks in reducing pain or opioid use for patients undergoing laparoscopic or robotic hysterectomies [177]. For laparotomy and minimally invasive procedures, quadratus lumborum and erector spinae plane blocks offer opioid-sparing benefits and decrease the incidence of post-operative nausea and vomiting [178,179]. Recent randomized controlled trials and prospective trials have shown that quadratus lumborum is more effective than TAP at decreasing visual analog scale and numeric rating scale somatic and visceral pain scores in the first 24 h after total abdominal hysterectomy [180–186]. Patients who received quadratus lumborum blocks had significantly less opioid consumption during the first 24 h, a longer time to first analgesic, and higher patient satisfaction compared to those who did not receive a block, received a placebo, or received a TAP block after laparoscopic or total abdominal hysterectomy [180–182,184,187–189].

Liposomal bupivacaine in quadratus lumborum blocks extends pain relief and reduces opioid use compared to conventional bupivacaine, although evidence is still emerging, and high-quality gynecologic oncology-specific trials are necessary [176]. In a recent randomized controlled trial combining bilateral erector spinae plane blocks with ERAS pathways in major gynecologic surgery, the authors reported greater patient satisfaction with pain management at rest and during activity than in the control group. Additionally, the erector spinae plane block group showed higher overall satisfaction with postoperative recovery and higher QoR-15 scores [190].

The very few and most recent randomized controlled trials comparing the erector spinae plane block and TAP blocks regarding the quality of recovery and postoperative pain after laparoscopic and total abdominal hysterectomy have found that the erector spinae plane block is more effective than the TAP in reducing opioid consumption, improving quality of recovery, decreasing postoperative pain scores up to 16 h after surgery, and enabling earlier mobilization [191,192].

Observational studies and randomized controlled trials on lung-protective ventilation report optimal tidal volumes of 6–8 mL/kg and positive end expiratory pressure levels during abdominal laparoscopic surgery in the Trendelenburg position. The authors suggested that zero end-expiratory pressure should be avoided, and moderate positive end expiratory pressure within the 4 to 8 cm H₂O range appears to lead to better outcomes compared with higher positive end expiratory pressure levels above 10 cm H₂O [173,193].

Summary and Recommendations:

The use of short-acting anesthetics, monitoring of neuromuscular block depth, and complete reversal is recommended.

Evidence level:

Short-acting anesthetics: Low.

Objective monitoring of the level of neuromuscular block and ensuring complete reversal: High.

Recommendation grade: Strong.

Use of protective ventilation.

Evidence level: Moderate.

Recommendation grade: Strong.

A perioperative multimodal analgesic protocol successfully reduces opioid use, both during the hospital journey and at discharge. This can be achieved using non-opioid oral medications and incisional injection of local anesthetic or fascial plane blocks such as TAP, quadratus lumborum and erector spinae plane decrease the need for systemic opioids.

Evidence level:

Use of multimodal analgesia: High.

Combination of acetaminophen and non-steroidal anti-inflammatory drugs: High.

Incisional injection of bupivacaine: High.

Transversus abdominis plane blocks: Low.

Quadratus Lumborum plane blocks: Moderate.

Erector Spinae plane block: Low.

Recommendation grade: Strong.

3.10. Perioperative fluid management and goal-directed fluid therapy

Optimization of fluid balance can be accomplished through 1) appropriate fasting times, 2) avoidance of bowel preparations (unless indicated), and 3) carbohydrate loading 2 h prior to surgery.

Three fluid administration strategies have been used for patients undergoing major gynecologic oncology surgery:

1) Liberal fluid strategy: Involves accepting a higher positive fluid balance, does not prevent hypotension [194] and is associated with surgical site infection [195] and increased major postoperative complications following ovarian cancer surgery [196]. Higher fluid balances increase adjusted post-operative length of stay [197].

2) Restrictive fluid strategy: Definitions of fluid restriction vary among studies, but restrictive regimens (1–2 L, compared to 2–3 L) have been safely used as part of ERAS protocols [198].

3) Goal-directed fluid therapy (GDFT): The inconsistent adoption of GDFT strategies has resulted in wide variation in fluid administration practices in gynecologic oncology surgery. [197–199].

The 2019 ERAS Society guidelines strongly recommended perioperative GDFT as it reduces length of stay and complications in high-risk patients undergoing abdominal surgery [7,200,201]. In addition, early discontinuation of intravenous fluids in the postoperative setting was supported with resumption of oral intake within 4 h with or without bowel resection [202]. Since then, 3 RCTs evaluating GDFT in the gynecologic oncology population have been published [203–205], one of which found GDFT was associated with lower ICU admission, ICU comorbidity and complication rates [205]. Goswami et al. reported a lower median length of stay (3 vs 4 days) with GDFT compared to control group, but this was not statistically significant [203]. Frassanito et al. reported reduced intraoperative hypotension associated with GDFT using a machine learning algorithm compared to a protocol aimed to stroke volume index optimization [204].

A recent meta-analysis concluded that in oncologic surgery ($n = 24$ RCTs, with 2358 patients), intraoperative GDFT significantly reduced length of stay by 1.6 days, lowered complication rates (RR 0.74) and facilitated earlier return of bowel function by 0.6 days [206]. This included pooled data from 2 RCTs that exclusively recruited gynecologic oncology patients [203,205], and 2 RCTs that included a mixed (gynecology and other) surgical population [207,208]. Different devices were used and interventions varied (colloid and vasoactive drugs [203], colloids and crystalloids [207], colloids, crystalloids and vasoactive drugs [208], and crystalloids and vasoactive drugs [205]).

A RCT in a mixed high risk surgical population ($n = 188$) reported fewer major complications associated with GDFT (maintaining baseline preoperative cardiac index with fluid and dobutamine; RR 0.54) [209], compared to standard management. Two pre- vs post-intervention studies using GDFT in gynecologic oncology patients also demonstrated fewer complications compared to standard management [210,211]. Collectively, findings are consistent with prior investigations showing less fluid administration (approximately 500 mls) with ERAS protocols which adopt a GDFT strategy [212]. Optimal monitoring technique and treatment algorithms require further study.

Summary and recommendation: Perioperative GDFT reduces hospital length of stay and complication rates in patients undergoing major gynecologic oncology surgery.

Evidence level: High.

Recommendation grade: Strong.

3.11. Minimally invasive surgery (MIS)

Incorporating minimally invasive surgery (MIS) into ERAS practices ensures that MIS adds value to cancer care by mitigating surgical morbidity, optimizing postoperative recovery, and safeguarding or improving oncologic outcomes.

For uterine-confined endometrial cancer, MIS is standard of care. Equivalent oncologic outcomes and improved recovery compared to

open surgery make MIS a key ERAS intervention in this population [213,214]. For operable cervical cancer, level 1 evidence supports open surgery, because it demonstrates superior long-term survival, with no measurable recovery advantage for minimally invasive approaches [215–217].

MIS for ovarian cancer is characterized by evolving practice and substantial evidence gaps. Cytoreduction to no gross residual is paramount for survival; open surgery is advised if MIS cannot achieve this goal. MIS is the preferred approach for risk-reducing surgery, management of early-stage disease and assessing disease resectability. Prospective, single-arm studies and emerging RCTs suggest that MIS facilitates ERAS-driven recovery outcomes in appropriately selected cases of interval cytoreductive surgery after neoadjuvant chemotherapy. Survival outcomes are pending. The risk of port site metastases is highest with ovarian cancer, warranting evaluation of preventive strategies [218–221].

Single-incision approaches and V-NOTES remain in limited use with insufficient outcome data. Recent RCTs show that using a 5 mm instead of an 11 mm primary trocar reduces postoperative pain [222], that mini-laparoscopic trocars combined with low-pressure pneumoperitoneum does not improve quality of recovery [223]. There is a reduction in vaginal dehiscence and other cuff-related complications with intracorporeal as opposed to transvaginal cuff closure at the end of laparoscopic hysterectomy [224].

Utilizing standardized ERAS order sets that omit bowel preps [84] and passive voiding trials [225,226] synergize with MIS to shorten PACU length of stay and facilitate safe same day discharge (SDD) [227, 228]. When combined with ERAS pathways, SDD rates are significantly improved; target SDD rates are 90% for benign and 70–80% for gynecologic oncology cases [229].

Summary and recommendations:

MIS for uterine confined endometrial cancer and laparotomy for operable cervical cancer combined with ERAS protocols should be used to optimize perioperative recovery.

Evidence level: High.

Recommendation grade: Strong.

ERAS pathway utilization should be aligned with the surgical approach that best supports the oncologic goal of care for patients at risk or diagnosed with ovarian cancer.

Evidence level: High.

Recommendation grade: Strong.

Minimizing primary trocar size (5 mm instead of 11 diameter trocar) and intracorporeal rather than transvaginal colpotomy closure support ERAS goals by reducing postoperative pain and vaginal cuff related complications, respectively.

Evidence level: Moderate.

Recommendation grade: Strong.

Modifications to MIS ERAS protocols, including omission of passive voiding trials, can improve same day discharge metrics.

Evidence level: High.

Recommendation grade: Strong.

3.12. Opioid sparing postoperative analgesia

Multimodal opioid-sparing analgesia forms the backbone of successful postoperative ERAS protocols. Recent studies confirm that local anesthesia and postoperative non-opioid oral analgesia (acetaminophen, NSAIDs) minimize opioid consumption after open and minimally invasive gynecologic surgery [7,8,230,231]. Preoperative expectation setting and standardized prescribing practices reduce overprescription but even with tiered discharge opioid algorithms, 75% of patients are still overprescribed [232–235]. Restrictive protocols (one to five tablets of oxycodone, 5 mg) and even discharge without an opioid prescription is safe, feasible, and does not increase patient symptom burden, calls, or refills [236–239].

Epidural analgesia, transversus abdominis plane blocks, and incisional injection of bupivacaine have shown efficacy, although each has advantages and disadvantages [240–243]. A prospective randomized trial comparing liposomal bupivacaine combined with 0.25% bupivacaine showed no benefit over 0.25% bupivacaine alone in patients undergoing laparotomy for gynecologic indications [244]. Emerging evidence points to a benefit for combining incisional and regional approaches in certain situations. A randomized controlled trial demonstrated reduced need for intravenous opioids ($p < 0.001$) and total opioid requirements ($p < 0.001$) in the first 24 h after laparotomy for gynecologic malignancy when a one-time injection of intraoperative intrathecal hydromorphone was added to incisional injection of liposomal bupivacaine [245].

A recent dramatic shift in perioperative management of buprenorphine when being used to treat opioid use disorder advocates for continuation of buprenorphine instead of preoperative abstinence. Studies show a reduction in postoperative pain scores and opioid dispensing with this approach [246]. A systematic review and meta-analysis of randomized controlled trials using buprenorphine instead of full agonist opioids in patients without opioid use disorder also demonstrated superior postoperative pain management, a longer duration of action, and no difference in adverse effects [247]. Suzetrigine, an oral nonopioid for moderate to severe acute pain, was FDA approved in January 2025 and has shown efficacy in patients undergoing abdominoplasty or bunionectomy but is significantly more expensive than opioids [248].

Summary and recommendations:

Multimodal analgesia including locoregional anesthesia reduces opioid use and continues to form the cornerstone of postoperative pain management in ERAS protocols. Combination strategies may include the evolving combination of incisional and intrathecal modalities. Restrictive (one to five tablets) and no-opioid outpatient prescription protocols should be considered in most patients. Buprenorphine and suzetrigine show promise for incorporation into ERAS in place of full agonist opioids; such as oxycodone or hydromorphone.

Use of multimodal analgesia.

Evidence level: High.

Recommendation grade: Strong.

Combination of acetaminophen and non-steroidal anti-inflammatory drugs.

Evidence level: High.

Recommendation grade: Strong.

Incisional injection of standard bupivacaine.

Evidence level: High.

Recommendation grade: Strong.

Intrathecal analgesia.

Evidence level: Moderate.

Recommendation grade: Strong.

Perioperative buprenorphine continuation in patients with opioid use disorder.

Evidence level: High.

Recommendation grade: Strong.

Use of buprenorphine instead of full opioid agonists for postoperative pain.

Evidence level: Moderate.

Recommendation grade: Weak.

Restrictive or no-opioid discharge opioid prescribing.

Evidence level: High.

Recommendation grade: Strong.

Suzetrigine use instead of full opioid agonists for postoperative pain.

Evidence level: Moderate.

Recommendation grade: Weak.

3.13. Urinary drainage

Indwelling bladder catheters should be removed as early as possible in the postoperative period (on the day of surgery for MIS, and no later

than POD1 for laparotomy, including patients undergoing radical hysterectomy) unless contraindications exist [8]. In patients who develop urinary retention, intermittent self-catheterization can be used instead of reinserting an indwelling bladder catheter [249–252]. The time to recovery of spontaneous voiding is not affected by the type of surgical approach [253].

For patients with unintentional bladder injury or those undergoing elective cystotomy or partial bladder resection, the catheter should remain in place for at least 7 days to ensure adequate bladder healing. In irradiated patients or those with complex bladder or ureteric reconstructions, urinary drainage for 2–4 weeks may be required, and a cysto- (uretero)-gram is advised to ensure complete healing before catheter removal [254].

Summary and recommendation:

Indwelling bladder catheters should be removed as early as possible in the postoperative period (on the day of surgery for MIS, and no later than POD1 for laparotomy), including patients undergoing radical hysterectomy, unless contraindications exist (see below).

Evidence: Moderate.

Recommendation: Strong.

Urinary catheters should remain in place for 7 days in patients with elective or traumatic cystotomy or cystectomy. Irradiated patients and those undergoing ureteral reconstruction may require drainage longer than one week. A cystogram is encouraged prior to catheter removal for patients with more complex repairs to ensure complete healing.

Evidence: Low.

Recommendation grade: Strong.

3.14. Early mobilization

Early mobilization after surgery can include sitting from lying, transferring from bed to chair, standing from sitting, and walking. There is no direct evidence from gynecologic oncology surgery, comparing early mobilization to a control group. The physiological stress of surgery and being immobilized during hospitalizations can range from deleterious effects on insulin resistance, decreased bowel function, increased risk of venous thromboembolism, among others [255–257]. The benefits of early mobilization after surgery have been demonstrated in other types of surgery, and one study found that compliance with early mobilization recommendations was associated with reduced complications and hospital length of stay [258–260]. Moreover, one study has found that compliance with early mobilization recommendations is one of three components most strongly associated with reduced risk of complications [261]. Another consideration is the “dose” of mobilization patients receive; some evidence suggests that there is a linear relationship between the number of steps patients walk and their hospital length of stay [262,263].

One potential reason for the paucity of evidence exploring the efficacy or effectiveness of early mobilization may be the challenge in measuring mobilization post-operatively. The recent advancements in wearable technology, may facilitate better monitoring and evaluation of early mobilization. Indeed, one study has shown that wearable devices can increase mobilization after surgery [264,265].

Summary and recommendation: Patients should be encouraged to mobilize within 24 h of surgery. The nursing and allied health resources to support patients in mobilizing within 24 h are needed.

Evidence level: Low.

Recommendation grade: Strong.

3.15. Discharge pathways

Adoption of ERAS protocols is associated with statistically significant reductions in length of stay [2], which reduces the time available to provide education and counselling in a hospital setting. The quality of discharge information provided has been shown to influence patients' use of discharge instructions and their ability to participate in their

care [266], emphasizing the importance of the provision of high-quality discharge information as a critical aspect of surgical care. While ERAS protocols are associated with a decrease in post-operative complications [2], when complications occur, patients report that standard written information alone is insufficient to help them determine when more care is needed [17]. Multiple digital tools/applications ('apps') have been developed to enable real-time monitoring of patient symptoms [267]. Digital monitoring of symptoms facilitates timely detection of complications, facilitating earlier intervention [267]. Evidence from small cohort studies and RCTs has demonstrated that app-based follow-up is associated with improved adherence to discharge instructions and a reduction in readmissions [268,269]. Additionally, patients typically report that electronic monitoring systems are easy to use and improve their overall satisfaction with care [267,268,270]. If digital follow-up is not possible, patients may benefit from having a standard point of contact if they develop concerning symptoms or have additional questions about their recovery that they can access outside of a scheduled follow-up visit [17].

Summary and recommendation: Provision of clear and understandable discharge information is a critical aspect of ERAS protocols. Emerging evidence supports the superiority of digital tools or apps (compared to verbal/written instructions alone) to facilitate adherence to discharge instructions and early identification of complications.

Evidence level: Low.

Recommendation grade: Strong.

3.16. Audit and reporting

Audit and feedback are a core component of all ERAS guidelines [7, 271], because it allows for monitoring of compliance with ERAS recommended care, which can trigger interventions to improve compliance if found to be low. Mounting evidence suggests that compliance with ERAS guidelines improves outcomes. One study reported that among patients undergoing gynecologic oncology surgery, each one-point increase in ERAS guideline compliance was associated with an 8% reduction in hospital length of stay for low-complexity cases (IRR 0.92; 95% CI, 0.90–0.95; $P < 0.001$) and a 12% reduction for medium- or high-complexity cases (IRR 0.88; 95% CI, 0.82–0.93; $P < 0.001$) [272]. Compliance of at least 80% to ERAS protocols in gynecologic oncology has been found to be associated with lower complication rates, fewer 30-day readmissions, and shorter hospital stays, without affecting reoperation rates [273]. These findings extend to studies beyond gynecologic oncology surgery [274–277].

While there are no studies directly comparing audit and feedback of ERAS guidelines in gynecologic oncology to a control group without audit and feedback, there is some indirect evidence that should be considered [278,279]. It has been long held that measuring quality of care using quality indicators can improve care, but though quality indicators are necessary they are not sufficient to improve care, but including a feedback mechanism further improves care [278]. A recent Cochrane Review of the effectiveness of audit and feedback confirms the previously reported effectiveness of audit and feedback on practice change [279]. Using meta-analysis, it was found that audit and feedback resulted in a 6.2% (95% CI = 4.1–8.2) increase in desired practice change [279].

Taken together, evidence suggests that audit and feedback is effective at changing practices, such as being compliant with ERAS guidelines and compliance with ERAS recommended care improves patient outcomes. There is also little evidence exploring the cost of implementing audit and feedback, but some evidence suggests there is a return on investment [280,281]. One strategy that might reduce the cost burden of audit and feedback is leveraging natural language processing and artificial intelligence to extract data from electronic medical records, as has been done for auditing hospital safety [282,283].

Summary and recommendation: Audit and feedback remain an essential component of an ERAS program. Audit and feedback should be used to monitor and report compliance to each ERAS guideline component, as this is associated with improved clinical outcomes. ERAS teams should aim for overall protocol compliance of at least 80%.

Evidence level:

Use of auditing to improve compliance: Moderate.

Correlation of compliance with improved outcomes: Moderate.

ERAS protocol compliance of at least 80% to improve outcomes: Moderate.

Recommendation grade: Strong.

4. Summary

This 2026 update represents the third revision of the ERAS® Society guidelines for perioperative care in gynecologic oncology and synthesizes the most robust evidence currently available. Building on the original 2016 publication [5,6] and subsequent updates in 2019 [7] and 2023 [8], recommendations were formulated from high-quality gynecologic oncology data where possible. When such data were lacking, the panel drew on rigorous appraisal of evidence from other relevant surgical fields (e.g. colorectal surgery), complemented by structured expert consensus from an international, multidisciplinary group. These guidelines are intended both to support teams initiating ERAS pathways and to help mature programs refine practice, while simultaneously highlighting areas where further research is needed. Although defining best practice is inherently complex, an even greater challenge lies in embedding these practices into everyday care through coordinated efforts among gynecologic oncologists, anesthesiologists, nurses, and the wider perioperative team. Continuous monitoring and analysis of outcomes, with iterative adjustments to enhance ERAS compliance, are essential to optimize perioperative pathways, accelerate recovery, and improve surgical quality and oncologic outcomes for patients undergoing gynecologic cancer surgery worldwide.

CRedit authorship contribution statement

Gregg Nelson: Conceptualization, Methodology, Project administration, Writing – original draft, Writing – review & editing. **Alon D. Altman:** Writing – original draft, Writing – review & editing. **Amy Metcalfe:** Writing – original draft, Writing – review & editing. **Christina Fotopoulou:** Writing – original draft, Writing – review & editing. **Jolyn Taylor:** Writing – original draft, Writing – review & editing. **Gretchen Glaser:** Writing – original draft, Writing – review & editing. **Jamie Bakkmum-Gamez:** Writing – original draft, Writing – review & editing. **Amanika Kumar:** Writing – original draft, Writing – review & editing. **Larissa A. Meyer:** Writing – original draft, Writing – review & editing. **Rebecca Stone:** Writing – original draft, Writing – review & editing. **Gabriel Mena:** Writing – original draft, Writing – review & editing. **Kevin M. Elias:** Writing – original draft, Writing – review & editing. **Steven P. Bisch:** Writing – original draft, Writing – review & editing. **Oliver Zivanovic:** Writing – original draft, Writing – review & editing. **Ester Miralpeix:** Writing – original draft, Writing – review & editing. **Geetu Bhandoria:** Writing – original draft, Writing – review & editing. **Ane Gerda Zahl Eriksson:** Writing – original draft, Writing – review & editing. **Shannon M. Ruzycski:** Writing – original draft, Writing – review & editing. **Pervez Sultan:** Writing – original draft, Writing – review & editing. **Khara M. Sauro:** Writing – original draft, Writing – review & editing. **Lindsay Blake:** Methodology, Project administration, Supervision, Writing – original draft, Writing – review & editing. **Mary E. Brindle:** Methodology, Supervision, Validation, Writing – review & editing. **Pedro T. Ramirez:** Conceptualization, Methodology, Project administration, Supervision, Writing – original draft, Writing – review & editing. **Sean C. Dowdy:** Conceptualization, Methodology, Project administration, Supervision, Writing – original draft, Writing – review & editing.

Funding

This project did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Declaration of competing interest

Dr. Nelson reports personal fees from Intuitive, Integra Life Sciences, and Smith & Nephew, outside the submitted work. He is the Chair of the Scientific Committee of the ERAS® Society, and Associate Editor of *Gynecologic Oncology*.

Dr. Altman reports personal fees from Merck, GSK, Abbvie, Eisai and Peervoice, outside the submitted work.

Dr. Metcalfe reports grants from Canadian Institutes of Health Research, Calgary Health Foundation, University of Calgary, Alberta Children's Hospital Foundation, Public Health Agency of Canada, and Alberta Medical Association, outside the submitted work. She also reports travel support from Canadian Partnership for Women and Children's Health, and a leadership position with the Society of Obstetricians and Gynecologists of Canada.

Dr. Fotopoulou reports personal fees from Oncinvent, GSK, Roche, AstraZeneca, MSD, and Medtronic outside the submitted work.

Dr. Taylor reports no disclosures.

Dr. Glaser reports no disclosures.

Dr. Bakkum-Gamez reports grants from the NIH/NCI and Exact Sciences outside the submitted work. She also reports a leadership position with the Foundation for Women's Cancer.

Dr. Kumar reports no disclosures.

Dr. Meyer reports stock or stock options from Johnson & Johnson, Invitae, Denali, Bristol Myer Squibb, outside the submitted work.

Dr. Stone reports a grant from Pacira BioSciences, outside the submitted work.

Dr. Mena reports a grant from Pacira Pharmaceutical, and consulting/personal fees from Conmed, Atricure outside the submitted work.

Dr. Elias reports a leadership position with ERAS USA.

Dr. Bisch reports travel support from the ERAS Society, and grants from Pharmacosmos A/N, Pfizer outside the submitted work.

Dr. Zivanovic reports royalties/licenses from Up-to-Date, speaker fees from GSK, MSD, Astra Zeneca, AbbVie outside the submitted work. He also reports travel support from ClinSol, If-Kongress, Medconcept GmbH, RG mbH, Aurikamed GmbH.

Dr. Miralpeix reports no disclosures.

Dr. Bhandoria reports a leadership position with the Association of Gynecologic Oncologists of India.

Dr. Zahl Eriksson reports speaker fees from Intuitive Surgical, outside the submitted work. She also reports travel support from the Society of Gynecologic Oncology, and European Society of Gynaecological Oncology; President Elect, European Society of Gynaecological Oncology.

Dr. Ruzycski reports grants from Alberta Innovates, Canadian Institutes of Health Research, and honoraria from University of Ottawa, University of Manitoba, Queens University outside the submitted work.

Dr. Sultan reports grants from NIH, outside the submitted work. He also reports a leadership position with the Society for Obstetric Anesthesia and Perinatology (SOAP).

Dr. Sauro reports no disclosures.

Dr. Blake reports no disclosures.

Dr. Brindle reports Secretary of the ERAS Society.

Dr. Ramirez reports no disclosures.

Dr. Dowdy reports travel support from the American College of Surgeons, outside the submitted work.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ygyno.2026.05.022>.

References

- [1] K.M. Elias, M.E. Brindle, G. Nelson, Enhanced recovery after surgery - evidence and practice, *NEJM Evid.* 4 (3) (2025), EVIDra2400012, <https://doi.org/10.1056/EVIDra2400012>.
- [2] K.M. Sauro, C. Smith, S. Ibadin, A. Thomas, H. Ganshorn, L. Bakunda, et al., Enhanced recovery after surgery guidelines and hospital length of stay, readmission, complications, and mortality: a meta-analysis of randomized clinical trials, *JAMA Netw. Open* 7 (6) (2024), e2417310, <https://doi.org/10.1001/jamanetworkopen.2024.17310>.
- [3] N. Thanh, A. Nelson, X. Wang, P. Faris, T. Wasylak, L. Gramlich, et al., Return on investment of the enhanced recovery after surgery (ERAS) multiguideline, multisite implementation in Alberta, Canada, *Can. J. Surg.* 63 (6) (2020) E542–E550, <https://doi.org/10.1503/cjs.006720>.
- [4] M. Brindle, G. Nelson, D.N. Lobo, O. Ljungqvist, U.O. Gustafsson, Recommendations from the ERAS® Society for standards for the development of enhanced recovery after surgery guidelines, *BJs Open.* 4 (1) (2020) 157–163, <https://doi.org/10.1002/bjs5.50238>.
- [5] G. Nelson, A.D. Altman, A. Nick, L.A. Meyer, P.T. Ramirez, C. Ahtari, et al., Guidelines for pre- and intra-operative care in gynecologic/oncology surgery: enhanced recovery after surgery (ERAS®) Society recommendations—Part I, *Gynecol. Oncol.* 140 (2) (2016) 313–322, <https://doi.org/10.1016/j.ygyno.2015.11.015>.
- [6] G. Nelson, A.D. Altman, A. Nick, L.A. Meyer, P.T. Ramirez, C. Ahtari, et al., Guidelines for postoperative care in gynecologic/oncology surgery: Enhanced Recovery After Surgery (ERAS®) Society recommendations—Part II, *Gynecol. Oncol.* 140 (2) (2016) 323–332, <https://doi.org/10.1016/j.ygyno.2015.12.019>.
- [7] G. Nelson, J. Bakkum-Gamez, E. Kaloogera, G. Glaser, A. Altman, L.A. Meyer, et al., Guidelines for perioperative care in gynecologic/oncology: Enhanced Recovery After Surgery (ERAS) Society recommendations-2019 update, *Int. J. Gynecol. Cancer* 29 (4) (2019) 651–668, <https://doi.org/10.1136/ijgc-2019-000356>.
- [8] G. Nelson, C. Fotopoulou, J. Taylor, G. Glaser, J. Bakkum-Gamez, L.A. Meyer, et al., Enhanced recovery after surgery (ERAS®) society guidelines for gynecologic oncology: addressing implementation challenges - 2023 update, *Gynecol. Oncol.* 173 (2023) 58–67, <https://doi.org/10.1016/j.ygyno.2023.04.009>.
- [9] G. Guyatt, A.D. Oxman, E.A. Akl, R. Kunz, G. Vist, J. Brozek, et al., GRADE guidelines: 1. Introduction—GRADE evidence profiles and summary of findings tables, *J. Clin. Epidemiol.* 64 (4) (2011) 383–394, <https://doi.org/10.1016/j.jclinepi.2010.04.026>.
- [10] <https://erasociety.org/guidelines/> Accessed May 10, 2026.
- [11] J.E. de Aguiar-Nascimento, F.S. Leal, D.C. Dantas, N.T. Anabuki, A.M. de Souza, Silva E. Lima VP, et al., Preoperative education in cholecystectomy in the context of a multimodal protocol of perioperative care: a randomized, controlled trial, *World J. Surg.* 38 (2) (2014) 357–362, <https://doi.org/10.1007/s00268-013-2255-7>.
- [12] P.M. Cavallaro, H. Milch, L. Savitt, R.A. Hodin, D.W. Rattner, D.L. Berger, et al., Addition of a scripted pre-operative patient education module to an existing ERAS pathway further reduces length of stay, *Am. J. Surg.* 216 (4) (2018) 652–657, <https://doi.org/10.1016/j.amjsurg.2018.07.016>.
- [13] K.S. Gurusamy, J. Vaughan, B.R. Davidson, Formal education of patients about to undergo laparoscopic cholecystectomy, *Cochrane Database Syst. Rev.* 2014 (2) (2014), CD009933, <https://doi.org/10.1002/14651858.CD009933.pub2>.
- [14] R. Powell, N.W. Scott, A. Manyande, J. Bruce, C. Vögele, L.M. Byrne-Davis, et al., Psychological preparation and postoperative outcomes for adults undergoing surgery under general anaesthesia, *Cochrane Database Syst. Rev.* 2016 (5) (2016), CD008646, <https://doi.org/10.1002/14651858.CD008646.pub2>.
- [15] F. Wang, C.B. Li, S. Li, Q. Li, Integrated interventions for improving negative emotions and stress reactions of young women receiving total hysterectomy, *Int. J. Clin. Exp. Med.* 7 (1) (2014) 331–336.
- [16] M.R. Teixeira, Oliveira GDS, Andrade CEM, R.L. Schmidt, V.A. Teodoro, P.G. Pedrão, et al., Impact of preoperative counseling and education on decreasing anxiety in patients with gynecologic tumors: a randomized clinical trial, *J. Surg. Oncol.* 131 (3) (2025) 535–543, <https://doi.org/10.1002/jso.27942>.
- [17] T. Sibbern, V. Bull Sellevold, S.A. Steindal, C. Dale, J. Watt-Watson, A. Dihle, Patients' experiences of enhanced recovery after surgery: a systematic review of qualitative studies, *J. Clin. Nurs.* 26 (9–10) (2017) 1172–1188, <https://doi.org/10.1111/jocn.13456>.
- [18] A.C. Pallett, B.T. Nguyen, N.M. Klein, N. Phippen, C.R. Miller, J.C. Barnett, A randomized controlled trial to determine whether a video presentation improves informed consent for hysterectomy, *Am. J. Obstet. Gynecol.* 219 (3) (2018) 277 e1–277 e7, <https://doi.org/10.1016/j.ajog.2018.06.016>.
- [19] R. Angioli, F. Plotti, S. Capriglione, A. Aloisi, M.E. Aloisi, D. Luvero, et al., The effects of giving patients verbal or written pre-operative information in gynecologic oncology surgery: a randomized study and the medical-legal point of view, *Eur. J. Obstet. Gynecol. Reprod. Biol.* 177 (2014) 67–71, <https://doi.org/10.1016/j.ejogrb.2014.03.041>.
- [20] S. Singh, G.G. Fletcher, X. Yao, J. Sussman, Virtual care in patients with cancer: a systematic review, *Curr. Oncol.* 28 (5) (2021) 3488–3506, <https://doi.org/10.3390/curroncol28050301>.
- [21] R. Han, J.N. Acosta, Z. Shakeri, Ioannidis JPA, E.J. Topol, P. Rajpurkar, Randomised controlled trials evaluating artificial intelligence in clinical practice: a scoping review, *Lancet Digit. Health* 6 (5) (2024) e367–e373.
- [22] O. Akdogan, G.C. Uyar, E. Yesilbas, K. Baskurt, N.A. Malkoc, N. Ozdemir, et al., Effect of a ChatGPT-based digital counseling intervention on anxiety and depression in patients with cancer: A prospective, randomized trial, *Eur. J. Cancer* 221 (2025), 115408.
- [23] A.A. Birkun, Y. Kosova, A. Rudenko, Generative artificial intelligence-mediated counselling on first aid for seizures: The performance of publicly available chatbot versus its customised version, *Epilepsy Behav.* 171 (2025), 110680.

- [24] E. Arslan, S. Ozkan, Effects of preoperative mobilization education using the teach-back method on patient outcomes after gynecological surgery: a randomized-controlled study, *Nurs. Health Sci.* 27 (2) (2025), e70151, <https://doi.org/10.1111/nhs.70151>.
- [25] E. Miralpeix, G. Mancebo, S. Gayete, M. Corcoy, J.M. Solé-Sedeño, Role and impact of multimodal prehabilitation for gynecologic oncology patients in an Enhanced Recovery After Surgery (ERAS) program, *Int. J. Gynecol. Cancer* 29 (8) (2019) 1235–1243, <https://doi.org/10.1136/ijgc-2019-000597>.
- [26] J.N. Silberman, A. Benjamin, P. Solk, D. Matei, R. Alter, E. Hinchcliff, et al., Fit4Surgery: A pilot randomized controlled trial to assess the feasibility of prehabilitation prior to debulking surgery for ovarian cancer, *Gynecol. Oncol.* 199 (2025) 116–123, <https://doi.org/10.1016/j.ygyno.2025.06.020>.
- [27] J. Kim, C.H. Lee, G.W. Yim, Multimodal prehabilitation for gynecologic cancer surgery, *Curr. Oncol.* 32 (2) (2025), 109, <https://doi.org/10.3390/curroncol32020109>.
- [28] E. Miralpeix, C. Rodríguez-Cosmen, B. Fabregó, J.M. Solé-Sedeño, J. Carazo, M. Sadurní, et al., Pre-operative impact of multimodal prehabilitation in gynecologic oncology patients, *Int. J. Gynecol. Cancer* 35 (2) (2025), 100062, <https://doi.org/10.1016/j.ijgc.2024.100062>.
- [29] R. Sebío-García, C. Celada-Castro, M.J. Arguís, M. Sisó, A. Torné, B. Tena, B. Díaz-Feijoo, G. Martínez-Palli, Multimodal prehabilitation improves functional capacity in patients with advanced ovarian cancer undergoing cytoreductive surgery, *Int. J. Gynecol. Cancer* (2024), ijgc-2024-005686, <https://doi.org/10.1136/ijgc-2024-005686>.
- [30] X. Li, L. Sha, Y. He, J. Yi, X. Wang, The impact of short-term multimodal prehabilitation on functional capacity in patients with gynecologic malignancies during the perioperative period: A prospective study, *Eur. J. Oncol. Nurs.* 70 (2024), 102577, <https://doi.org/10.1016/j.ejon.2024.102577>.
- [31] J. Dhanis, P. Pijnenborg JMA, van Laarhoven CJHM, S. Verlaan, B. van der Heuvel, A. Smits, The effect of a multimodal prehabilitation programme on preoperative physical fitness and nutritional status of women with gynaecological cancer, *Gynecol. Oncol.* 203 (2025) 1–7, <https://doi.org/10.1016/j.ygyno.2025.10.012>.
- [32] B. Díaz-Feijoo, N. Agustí-García, R. Sebío, A. López-Hernández, M. Sisó, A. Glickman, N. Carreras-Dieguez, P. Fuste, T. Marina, J. Martínez-Egea, L. Aguilera, J. Perdomo, A. Pelaez, M. López-Baamonde, R. Navarro-Ripoll, E. Gimeno, B. Campero, A. Torné, G. Martínez-Palli, M.J. Arguís, Feasibility of a multimodal prehabilitation programme in patients undergoing cytoreductive surgery for advanced ovarian cancer: a pilot study, *Cancers (Basel)* 14 (7) (2022) 1635, <https://doi.org/10.3390/cancers14071635>.
- [33] E. Miralpeix, J.M. Solé-Sedeño, C. Rodríguez-Cosmen, A. Taus, M.D. Muns, B. Fabregó, G. Mancebo, Impact of prehabilitation during neoadjuvant chemotherapy and interval cytoreductive surgery on ovarian cancer patients: a pilot study, *World J. Surg. Oncol.* 20 (1) (2022) 46, <https://doi.org/10.1186/s12957-022-02517-1>.
- [34] M. Campfort, T. Perrault, A. Blanchard-Daguet, E. Rineau, S. Lasocki, Associations between pre-operative iron deficiency and postoperative infection in patients undergoing major surgery (CARIPO): a prospective observational study, *Anaesthesia* 80 (2) (2025) 142–150, <https://doi.org/10.1111/anae.16498>.
- [35] O.W. Foley, B. Vega, D. Roque, E. Hinchcliff, J. Marcus, E.J. Tanner, et al., Characterization of pre-operative anemia in patients undergoing surgery by a gynecologic oncologist and association with post-operative complications, *Int. J. Gynecol. Cancer* 33 (11) (2023) 1778–1785, <https://doi.org/10.1136/ijgc-2023-004539>.
- [36] M.M. Mueller, H. Van Remoortel, P. Meybohm, et al., Patient blood management: recommendations from the 2018 Frankfurt consensus conference, *JAMA* 321 (10) (2019) 983–997, <https://doi.org/10.1001/jama.2019.0554>.
- [37] E. Spénard, Y. Lin, A. Covens, L.T. Gien, J. Callum, R. Tano, et al., Optimizing the screening and management of preoperative anemia prior to gynecologic oncology surgery (OPRA1): a quality improvement initiative, *Gynecol. Oncol.* 201 (2025) 7–16, <https://doi.org/10.1016/j.ygyno.2025.07.027>.
- [38] K. Hands, J. Daru, C. Evans, A. Kotze, C. Lewis, S. Narayan, et al., BSH Committee. Identification and management of preoperative anaemia in adults: a British Society for Haematology guideline update, *Br. J. Haematol.* 205 (1) (2024) 88–99, <https://doi.org/10.1111/bjh.19440>.
- [39] S. Harrogate, J. Barnes, K. Thomas, A. Isted, G. Kunst, S. Gupta, et al., Peri-operative tobacco cessation interventions: a systematic review and meta-analysis, *Anaesthesia* 78 (11) (2023) 1393–1408, <https://doi.org/10.1111/anae.16120>.
- [40] L.T. Sørensen, Wound healing and infection in surgery: the clinical impact of smoking and smoking cessation. A systematic review and meta-analysis, *Arch. Surg.* 147 (4) (2012) 373–383, <https://doi.org/10.1001/archsurg.2012.5>.
- [41] D. Khullar, J. Maa, The impact of smoking on surgical outcomes, *J. Am. Coll. Surg.* 215 (3) (2012) 418–426, <https://doi.org/10.1016/j.jamcollsurg.2012.05.023>.
- [42] A. Turan, E.J. Mascha, D. Roberman, et al., Smoking and perioperative outcomes, *Anesthesiology* 114 (4) (2011) 837–846.
- [43] D. Lindström, O. Sadr Azodi, A. Wladis, H. Tønnesen, S. Linder, H. Näsell, et al., Effects of a perioperative smoking cessation intervention on postoperative complications: a randomized trial, *Ann. Surg.* 248 (5) (2008) 739–745, <https://doi.org/10.1097/SLA.0b013e3181889d0d>.
- [44] D.P. Mason, S. Subramanian, E.R. Nowicki, et al., Impact of smoking cessation before resection of lung cancer: a Society of Thoracic Surgery Database study, *Ann. Thorac. Surg.* 88 (2) (2009) 362–371.
- [45] J.W. Egholm, B. Pedersen, A.M. Møller, J. Adami, C.B. Juhl, H. Tønnesen, Perioperative alcohol cessation intervention for postoperative complications, *Cochrane Database Syst. Rev.* 11 (11) (2018), CD008343, <https://doi.org/10.1002/14651858.CD008343.pub3>.
- [46] V. Di Donato, G. Caruso, G. Bogani, A. Giannini, O. D'Orta, G. Perniola, et al., Preoperative frailty assessment in patients undergoing gynecologic oncology surgery: a systematic review, *Gynecol. Oncol.* 161 (1) (2021) 11–19, <https://doi.org/10.1016/j.ygyno.2020.12.030>.
- [47] S.J. Mah, T. Anpalagan, M. Marcucci, L. Eiriksson, C.J. Reade, W. Jimenez, et al., The five-factor modified frailty index predicts adverse postoperative and chemotherapy outcomes in gynecologic oncology, *Gynecol. Oncol.* 166 (1) (2022) 154–161, <https://doi.org/10.1016/j.ygyno.2022.05.012>.
- [48] T.Y. Sia, T. Wen, S. Cham, A.M. Friedman, J.D. Wright, The effect of frailty on post-operative readmissions, morbidity, and mortality in endometrial cancer surgery, *Gynecol. Oncol.* 161 (2) (2021) 353–360, <https://doi.org/10.1016/j.ygyno.2021.02.022>.
- [49] S. Cham, A. Kumar, L.C. Walter, S. Lichtman, W.P. Tew, Understanding frailty and the role of patient-centered care for older adults with gynecologic cancer, *Gynecol. Oncol.* 196 (2025) 42–53, <https://doi.org/10.1016/j.ygyno.2025.03.035>.
- [50] A. Kumar, C.L. Langstraat, DeJong SR, McGree ME, J.N. Bakkum-Gamez, A.L. Weaver, et al., Functional not chronological age: frailty index predicts outcomes in advanced ovarian cancer, *Gynecol. Oncol.* 147 (1) (2017) 104–109, <https://doi.org/10.1016/j.ygyno.2017.07.126>.
- [51] S. Uppal, E. Igwe, L.W. Rice, R.J. Spencer, S.L. Rose, Frailty index predicts severe complications in gynecologic oncology patients, *Gynecol. Oncol.* 137 (1) (2015) 98–101, <https://doi.org/10.1016/j.ygyno.2015.01.532>.
- [52] K. Rockwood, A. Mitnitski, Frailty in relation to the accumulation of deficits, *J. Gerontol. A Biol. Sci. Med. Sci.* 62 (7) (2007) 722–727, <https://doi.org/10.1093/gerona/62.7.722>.
- [53] L.P. Fried, C.M. Tangen, J. Walston, A.B. Newman, C. Hirsch, J. Gottdiener, et al., Cardiovascular Health Study Collaborative Research Group. Frailty in older adults: evidence for a phenotype, *J. Gerontol. A Biol. Sci. Med. Sci.* 56 (3) (2001) M146–M156, <https://doi.org/10.1093/gerona/56.3.M146>.
- [54] O. Beauchet, B. Fantino, G. Allali, et al., Timed Up and Go test and risk of falls in older adults: a systematic review, *J. Nutr. Health Aging* 15 (10) (2011) 933–938, <https://doi.org/10.1007/s12603-011-0062-0>.
- [55] van Cappellen-van Maldegem SJM, M. Hoedjes, J.C. Seidell, L.V. van de Poll-Franse, L.M. Buffart, F. Mols, et al., Self-performed five times sit-to-stand test at home as (pre-)screening tool for frailty in cancer survivors: reliability and agreement assessment, *J. Clin. Nurs.* 32 (7–8) (2023) 1370–1380, <https://doi.org/10.1111/jocn.16299>.
- [56] J.S.L. Partridge, D. Harari, F.C. Martin, J.K. Dhesi, The impact of pre-operative comprehensive geriatric assessment on postoperative outcomes in older patients undergoing scheduled surgery: a systematic review, *Anaesthesia* 69 (Suppl. 1) (2014) 8–16, <https://doi.org/10.1111/anae.12494>.
- [57] L.A. Moukarzel, N. Nguyen, Q. Zhou, A. Iasonos, M.B. Schiavone, B. Ramesh, et al., Association of bowel preparation with surgical-site infection in gynecologic oncology surgery: post-hoc analysis of a randomized controlled trial, *Gynecol. Oncol.* 168 (2023) 100–106, <https://doi.org/10.1016/j.ygyno.2022.11.003>.
- [58] C.C. Wang, R. Al-Rubaye, V. Tran, L. Montemoro, A. Al-Niaimi, Mechanical and oral antibiotic bowel preparation in ovarian cancer debulking: Are we lowering or just trading surgical complications? *Gynecol. Oncol.* 166 (1) (2022) 76–84, <https://doi.org/10.1016/j.ygyno.2022.05.007>.
- [59] R.L. Nelson, M. Hassan, M.D. Grant, Antibiotic prophylaxis in colorectal surgery: are oral, intravenous or both best and is mechanical bowel preparation necessary? *Tech. Coloproctol.* 24 (12) (2020) 1233–1246, <https://doi.org/10.1007/s10151-020-02301-x>.
- [60] J. Tan, E.J. Ryan, M.G. Davey, F.T. McHugh, B. Creavin, M.C. Whelan, et al., Mechanical bowel preparation and antibiotics in elective colorectal surgery: network meta-analysis, *BJs Open*. 7 (3) (2023), zrad040, <https://doi.org/10.1093/bjsopen/zrad040>.
- [61] J.W.T. Toh, K. Phan, K. Hitos, N. Pathma-Nathan, T. El-Khoury, A.J. Richardson, et al., Association of mechanical bowel preparation and oral antibiotics before elective colorectal surgery with surgical site infection: a network meta-analysis, *JAMA Netw. Open* 1 (6) (2018), e183226, <https://doi.org/10.1001/jamanetworkopen.2018.3226>.
- [62] G.S.A. Abis, H.B.A.C. Stockmann, H.J. Bonjer, N. van Veenendaal, M.L.M. van Doorn-Schepens, A.E. Budding, et al., SELECT trial study group. Randomized clinical trial of selective decontamination of the digestive tract in elective colorectal cancer surgery (SELECT trial), *Br. J. Surg.* 106 (4) (2019) 355–363, <https://doi.org/10.1002/bjs.11117>.
- [63] A. Arezzo, M. Mistrangelo, M.A. Bonino, P. Salusso, E. Forcignanò, N. Vettoretto, et al., Oral neomycin and bacitracin are effective in preventing surgical site infections in elective colorectal surgery: a multicentre, randomized, parallel, single-blinded trial (COLORAL-1), *Updates Surg.* 73 (5) (2021) 1775–1786, <https://doi.org/10.1007/s13304-021-01112-5>.
- [64] C.H. Koo, A.Y. Chok, I.J.Y. Wee, I. Seow-En, Y. Zhao, E.J.K.W. Tan, Effect of preoperative oral antibiotics and mechanical bowel preparation on the prevention of surgical site infection in elective colorectal surgery, and does oral antibiotic regime matter? a bayesian network meta-analysis, *Int. J. Color. Dis.* 38 (1) (2023) 151, <https://doi.org/10.1007/s00384-023-04444-3>.
- [65] L. Koskenvuo, P. Lunkka, P. Varpe, M. Hyöty, R. Satokari, C. Haapamäki, et al., Morbidity after mechanical bowel preparation and oral antibiotics prior to rectal resection: The MOBILE2 randomized clinical trial, *JAMA Surg.* 159 (6) (2024) 606–614, <https://doi.org/10.1001/jamasurg.2024.0184>.
- [66] S.T. McSorley, C.W. Steele, A.J. McMahon, Meta-analysis of oral antibiotics, in combination with preoperative intravenous antibiotics and mechanical bowel preparation the day before surgery, compared with intravenous antibiotics and mechanical bowel preparation alone to reduce surgical-site infections in elective colorectal surgery, *BJs Open*. 2 (4) (2018) 185–194, <https://doi.org/10.1002/bjs5.68>.
- [67] E. Rybakov, M. Nagudov, M. Sukhina, Y. Shelygin, Impact of oral antibiotic prophylaxis on surgical site infection after rectal surgery: results of randomized trial, *Int. J. Color. Dis.* 36 (2) (2021) 323–330, <https://doi.org/10.1007/s00384-020-03746-0>.

- [68] A. Singh, E. Zeb, H. Tumeh, M. Abdel-Halim, M. Solkar, A systematic review and meta-analysis comparing the efficacy of enteral antibiotics combined with mechanical bowel preparation versus mechanical bowel preparation alone in elective colorectal resections, *Cureus* 17 (7) (2025), e87991, <https://doi.org/10.7759/cureus.87991>.
- [69] T. Suzuki, S. Sadahiro, A. Tanaka, K. Okada, G. Saito, H. Miyakita, et al., Usefulness of preoperative mechanical bowel preparation in patients with colon cancer who undergo elective surgery: a prospective randomized trial using oral antibiotics, *Dig. Surg.* 37 (3) (2020) 192–198, <https://doi.org/10.1159/000500020>.
- [70] M.A. Willis, I. Toews, S.L. Soltan, J.C. Kalf, J.J. Meerpohl, Vilz TO, Preoperative combined mechanical and oral antibiotic bowel preparation for preventing complications in elective colorectal surgery, *Cochrane Database Syst. Rev.* 2 (2) (2023), CD014909, <https://doi.org/10.1002/14651858.CD014909.pub2>.
- [71] J.C. Woodfield, K. Clifford, B. Schmidt, G.A. Turner, M.A. Amer, J.L. McCall, Strategies for antibiotic administration for bowel preparation among patients undergoing elective colorectal surgery: a network meta-analysis, *JAMA Surg.* 157 (1) (2022) 34–41, <https://doi.org/10.1001/jamasurg.2021.5251>.
- [72] Y. Yue, X. Chen, H. Wang, M. Cheng, B. Zheng, Mechanical bowel preparation combined with oral antibiotics reduces infectious complications and anastomotic leak in elective colorectal surgery: a pooled-analysis with trial sequential analysis, *Int. J. Color. Dis.* 38 (1) (2023) 5, <https://doi.org/10.1007/s00384-022-04302-8>.
- [73] K.E. Rollins, H. Javanmard-Emamghissi, A.G. Acheson, D.N. Lobo, The role of oral antibiotic preparation in elective colorectal surgery: a meta-analysis, *Ann. Surg.* 270 (1) (2019) 43–58, <https://doi.org/10.1097/SLA.0000000000003145>.
- [74] M. Catarci, S. Guadagni, F. Masedu, M. Sartelli, L.A. Montemurro, G.L. Baiocchi, The Italian ColoRectal Anastomotic Leakage iCraL Study Group, et al., Oral antibiotics alone versus oral antibiotics combined with mechanical bowel preparation for elective colorectal surgery: a propensity score-matching re-analysis of the iCraL 2 and 3 prospective cohorts, *Antibiotics (Basel)* 13 (3) (2024), 235, <https://doi.org/10.3390/antibiotics13030235>.
- [75] G. Papp, G. Saffits, B.E. Szabó, J. Baracs, A. Vereczkei, D. Kollár, et al., Systemic versus Oral and Systemic Antibiotic Prophylaxis (SOAP) study in colorectal surgery: prospective randomized multicentre trial, *Br. J. Surg.* 108 (3) (2021) 271–276, <https://doi.org/10.1093/bjs/znaa131>.
- [76] S. Khorasani, F. Dossa, T. McKechnie, M. Englesakis, M.S. Brar, A. de Buck van Overstraeten, Association between preoperative oral antibiotics and the incidence of postoperative clostridium difficile infection in adults undergoing elective colorectal resection: a systematic review and meta-analysis, *Dis. Colon Rectum* 63 (4) (2020) 545–561, <https://doi.org/10.1097/DCR.0000000000001619>.
- [77] S. Arai, M. Hanaoka, S. Yamauchi, H. Baba, R. Hanazawa, H. Sato, et al., Modified oral antibiotics and mechanical bowel preparation (OAMBP) versus conventional OAMBP for sigmoid colon and rectal surgery: A multicenter randomized non-inferiority trial, *Ann. Gastroenterol. Surg.* 8 (6) (2024) 1036–1045, <https://doi.org/10.1002/ags3.12837>.
- [78] J.P.L. Leenen, J.E.K.R. Hentzen, H.D.L. Ockhuijsen, Effectiveness of mechanical bowel preparation versus no preparation on anastomotic leakage in colorectal surgery: a systematic review and meta-analysis, *Updates Surg.* 71 (2) (2019) 227–236, <https://doi.org/10.1007/s13304-018-0526-4>.
- [79] M. Martinez-Lopez, G. Fuschillo, F. Pata, M. Kraft Carré, Cirera D.E. Tudela A, F. Selvaggi, et al., Mechanical bowel preparation to prevent infective complications after colon and rectal surgery: a systematic review and meta-analysis of randomized controlled trials, *Minerva Surg.* 80 (4) (2025) 323–333, <https://doi.org/10.23736/S2724-5691.25.10740-5>.
- [80] K.E. Rollins, H. Javanmard-Emamghissi, D.N. Lobo, Impact of mechanical bowel preparation in elective colorectal surgery: a meta-analysis, *World J. Gastroenterol.* 24 (4) (2018) 519–536, <https://doi.org/10.3748/wjg.v24.i4.519>.
- [81] S.S. Apte, H. Moloo, A. Jeong, M. Liu, L. Vandemeer, K. Suh, et al., Prospective randomised controlled trial using the RETHinking Clinical Trials (REaCT) platform and National Surgical Quality Improvement Program (NSQIP) to compare no preparation versus preoperative oral antibiotics alone for surgical site infection rates in elective colon surgery: a protocol, *BMJ Open* 10 (7) (2020), e036866, <https://doi.org/10.1136/bmjopen-2020-036866>.
- [82] R. Hosseini, P. Gheshlaghi, N. Marjani, M. Fatehnezhad, M. Rezaeinejad, Comparing a clear liquid diet versus mechanical bowel preparation before laparoscopic gynecological surgery: a randomized clinical trial study, *J. Gynecol. Surg.* 41 (1) (2025) 27–31, <https://doi.org/10.1089/gyn.2023.0101>.
- [83] N. Kathopoulos, I. Chatzipapas, D. Valsamidis, K. Samartzis, D. Kipriotis, D. Loutradis, et al., Mechanical bowel preparation before gynecologic laparoscopic procedures: Is it time to abandon this practice? *J. Obstet. Gynaecol. Res.* 47 (4) (2021) 1487–1496, <https://doi.org/10.1111/jog.14674>.
- [84] U.K. Ozturk, S. Acar, S. Akış, E. Keles, C.M. Alınca, M. Api, The effect of mechanical bowel preparation on the surgical field in laparoscopic gynecologic surgeries: a prospective randomized controlled trial, *J. Invest. Surg.* 35 (7) (2022) 1604–1608, <https://doi.org/10.1080/08941939.2022.2081389>.
- [85] Z. Yang, F. Jiang, M. Jian, Y. Liu, Y. Zhang, Z. Zhang, et al., High glycemic variability serves as an independent risk factor for postoperative infection-related complications in patients undergoing radical surgery for gastric, colon, and rectal cancer, *Medicine (Baltimore)* 104 (7) (2025), e41602, <https://doi.org/10.1097/MD.00000000000041602>.
- [86] A. Akirov, T. Shochat, I. Dotan, T. Diker-Cohen, A. Gorshtein, I. Shimon, Glycemic variability and mortality in patients hospitalized in general surgery wards, *Surgery* 166 (2) (2019) 184–192, <https://doi.org/10.1016/j.surg.2019.02.022>.
- [87] A.R. Sebestyén, C. Turan, A. Szemere, M. Virág, K. Ocskay, F. Dombrovsky, et al., Preoperative carbohydrate loading reduces length of stay after major elective, non-cardiac surgery when compared to fasting: a systematic review and meta-analysis, *Sci. Rep.* 15 (1) (2025) 19119, <https://doi.org/10.1038/s41598-025-00767-z>.
- [88] J. Lu, J. Khamar, McKechnie T, Y. Lee, N. Amin, D. Hong, et al., Preoperative carbohydrate loading before colorectal surgery: a systematic review and meta-analysis of randomized controlled trials, *Int. J. Color. Dis.* 37 (12) (2022) 2431–2450, <https://doi.org/10.1007/s00384-022-04288-3> Epub 2022 Dec 6. PMID: 36472671.
- [89] D. Van Loi, L. Thi Tuyet, T. Thi Tuoi, N. Dinh Trung, N. Phuc Thanh, P. Xuan Hung, Preoperative maltodextrin solution intake improves patient comfort in gynecologic laparoscopic surgery: a randomized controlled trial, *Medicine (Baltimore)* 104 (26) (2025), e43056, <https://doi.org/10.1097/MD.00000000000043056>.
- [90] P.L. Cheng, E.W. Loh, J.T. Chen, K.W. Tam, Effects of preoperative oral carbohydrate on postoperative discomfort in patients undergoing elective surgery: a meta-analysis of randomized controlled trials, *Langenbecks Arch. Surg.* 406 (4) (2021) 993–1005, <https://doi.org/10.1007/s00423-021-02110-2>.
- [91] B. Wang, D. Han, X. Hu, J. Chen, Y. Liu, J. Wu, Perioperative liberal drinking management promotes postoperative gastrointestinal function recovery after gynecological laparoscopic surgery: A randomized controlled trial, *J. Clin. Anesth.* 97 (2024), 111539, <https://doi.org/10.1016/j.jclinane.2024.111539>.
- [92] G.P. Joshi, B.B. Abdelmalak, W.A. Weigel, M.W. Harbell, C.I. Kuo, S.G. Soriano, et al., 2023 American society of anesthesiologists practice guidelines for preoperative fasting: carbohydrate-containing clear liquids with or without protein, chewing gum, and pediatric fasting duration—A modular update of the 2017 American society of anesthesiologists practice guidelines for preoperative fasting, *Anesthesiology* 138 (2) (2023) 132–151, <https://doi.org/10.1097/ALN.0000000000004381>.
- [93] R.J. Canelli, J. Louca, R.M. Gonzalez, L.F. Rendón, C.R. Hartman, F. Bilotta, Trends in preoperative carbohydrate load practice: a systematic review, *JPEN. J. Parenter. Enteral Nutr.* 48 (5) (2024) 527–537, <https://doi.org/10.1002/jpen.2633>.
- [94] C. Churruangskul, K. Khanungwanitkul, A. Kaewborisutakul, C. Kitisripant, A. Rattanaburi, O. Suntornlohanakul, et al., Novel preoperative carbohydrate drinks versus commercial syrup-based drinks on gastric emptying, glycemic responses, and fasting discomfort: a pilot randomized crossover trial, *Nutrients* 17 (13) (2025), 2131, <https://doi.org/10.3390/nu17132131>.
- [95] B.A. Kielhorn, A.J. Senagore, T. Asgeirsson, The benefits of a low dose complex carbohydrate/citrulline electrolyte solution for preoperative carbohydrate loading: Focus on glycemic variability, *Am. J. Surg.* 215 (3) (2018) 373–376, <https://doi.org/10.1016/j.amjsurg.2017.10.029>.
- [96] K.N. Robinson, B.A. Cassidy, R.A. Hegazi, P.E. Wischmeyer, Preoperative carbohydrate loading in surgical patients with type 2 diabetes: are concerns supported by data? *Clin. Nutr. ESPEN* 45 (2021) 1–8, <https://doi.org/10.1016/j.clnesp.2021.08.023>.
- [97] S. Lee, J.Y. Sohn, H.J. Lee, S. Yoon, J.H. Bahk, B.R. Kim, Effect of pre-operative carbohydrate loading on aspiration risk evaluated with ultrasonography in type 2 diabetic patients: a prospective observational pilot study, *Sci. Rep.* 12 (1) (2022) 17521, <https://doi.org/10.1038/s41598-022-21696-1>.
- [98] M. Vishak, B. Gayathri, G. Chandrasekar, S. Ramani, Randomized controlled trial comparing the effects of preoperative carbohydrate and non-carbohydrate loading on gastric emptying in diabetic and non-diabetic patients posted for elective surgery, *Cureus* 15 (11) (2023), e49213, <https://doi.org/10.7759/cureus.49213>.
- [99] S. Wang, J. Zhang, Q. Liu, L. Deng, Clinical value of preoperative oral carbohydrate loading in patients with diabetes: a cross-sectional study, *BMC Anesthesiol.* 25 (1) (2025) 289, <https://doi.org/10.1186/s12871-025-03165-0>.
- [100] S. Suh, E. Hetzel, K. Alter-Troilo, K. Lak, J.C. Gould, T.L. Kindel, et al., The influence of preoperative carbohydrate loading on postoperative outcomes in bariatric surgery patients: a randomized, controlled trial, *Surg. Obes. Relat. Dis.* 17 (8) (2021) 1480–1488, <https://doi.org/10.1016/j.soard.2021.04.014>.
- [101] D.E. Azagury, F. Ris, C. Pichard, F. Volonté, L. Karsgaard, O. Huber, Does perioperative nutrition and oral carbohydrate load sustainably preserve muscle mass after bariatric surgery? A randomized control trial, *Surg. Obes. Relat. Dis.* 11 (4) (2015) 920–926, <https://doi.org/10.1016/j.soard.2014.10.016>.
- [102] J. Elkin, S. Rele, P. Sumithran, M. Hii, S. Thuraisingam, T. Spelman, et al., Association between glucagon-like peptide-1 receptor agonist use and peri-operative pulmonary aspiration: a systematic review and meta-analysis, *Anaesthesia* 80 (7) (2025) 846–858, <https://doi.org/10.1111/anae.16601>.
- [103] J.D. Wright, L. Chen, X. Xu, C. Hur, K. Matsuo, E.B. Elkin, et al., Glucagon-like-peptide-1 (GLP-1) receptor agonist use and the risk of pulmonary aspiration in patients undergoing surgery, *Int. J. Surg.* 111 (6) (2025) 4090–4093, <https://doi.org/10.1097/JS9.0000000000002425>.
- [104] B. Hiramoto, T.R. McCarty, N.A. Lodhia, A. Jenkins, A. Elnaïem, M. Muftah, et al., Quantified metrics of gastric emptying delay by Glucagon-Like Peptide-1 agonists: a systematic review and meta-analysis with insights for periprocedural management, *Am. J. Gastroenterol.* 119 (6) (2024) 1126–1140, <https://doi.org/10.14309/ajg.0000000000002820>.
- [105] S.K. Kamarajah, N. Gudizozzi, J.M. Findlay, M.J. Lee, T. Pinkney, S.R. Markar, Evaluation of safety of preoperative GLP-1 receptor agonists in patients undergoing elective surgery: a systematic review, meta-analysis and meta-regression, *EJclinMed* (87) (2025), 103408, <https://doi.org/10.1016/j.ejclinm.2025.103408>.
- [106] T.L. Kindel, A.Y. Wang, A. Wadhwa, A.R. Schulman, R.Z. Sharaiha, M. Kroh, American Gastroenterological Association, American Society for Metabolic and Bariatric Surgery, American Society of Anesthesiologists, International Society of Perioperative Care of Patients with Obesity, Society of American Gastrointestinal and Endoscopic Surgeons, et al., Multisociety clinical practice guidance for the safe use of Glucagon-like Peptide-1 receptor agonists in the perioperative period, *Clin. Gastroenterol. Hepatol.* 23 (12) (2025) 2083–2085, <https://doi.org/10.1016/j.jcgh.2024.10.003>.

- [107] G.P. Joshi, B.B. Abdelmalak, W.A. Weigel, S.G. Soriano, M.W. Harbell, C.I. Kuo, et al., American Society of Anesthesiologists Consensus-based Guidance on Preoperative Management of Patients (adults and children) on Glucagon-Like Peptide-1 (GLP-1) Receptor Agonists, Last updated: June 2023 <https://www.asahq.org/about-asah/newsroom/news-releases/2023/06/american-society-of-anesthesiologists-consensus-based-guidance-on-preoperative-2023>.
- [108] M.C. Grant, M.M. Gibbons, C.Y. Ko, E.C. Wick, M. Cannesson, M.J. Scott, et al., Evidence review conducted for the AHRQ Safety Program for Improving Surgical Care and Recovery: focus on anesthesiology for gynecologic surgery, *Reg. Anesth. Pain Med.* (2019), rapm-2018-100071, <https://doi.org/10.1136/rapm-2018-100071>.
- [109] T.D. Tubog, C.M. Harmer, R.S. Bramble, N.E. Bayaua, M. Mijares, Efficacy and safety of gabapentin on postoperative pain management after bariatric surgery: a systematic review and meta-analysis, *J. Perianesth. Nurs.* 38 (2) (2023) 322–330, <https://doi.org/10.1016/j.jopan.2022.04.017>.
- [110] G.B. Costa, L.A. Ferreira, M.A. Delgado, A.N. Soares, C.J.C. Junior, Preoperative gabapentin for pain control: a randomized, placebo-controlled clinical trial in patients undergoing inguinal hernioplasty, *J. Perianesth. Nurs.* 39 (6) (2024) 1006–1011, <https://doi.org/10.1016/j.jopan.2024.01.018>.
- [111] C.M. Park, S.K. Inouye, E.R. Marcantonio, E. Metzger, B.T. Bateman, J.J. Lie, et al., Perioperative gabapentin use and in-hospital adverse clinical events among older adults after major surgery, *JAMA Intern. Med.* 182 (11) (2022) 1117–1127, <https://doi.org/10.1001/jamainternmed.2022.3680>.
- [112] T.Q. Huynh, N.R. Patel, N.D. Goldstein, G.E. Makai, Preoperative gabapentin for minimally invasive hysterectomy: a randomized controlled trial, *J. Minim. Invasive Gynecol.* 28 (2) (2021) 237–244.e2, <https://doi.org/10.1016/j.jmig.2020.04.040>.
- [113] K. Güngördük, Ö. Arslaner, B.Ş. Uyar, E. Biton, B.N. Ergü, V. Gülsiren, Effectiveness of perioperative duloxetine for pain management in vNOTES hysterectomy: a randomized, placebo-controlled trial, *Eur. J. Obstet. Gynecol. Reprod. Biol.* 313 (2025), 114594, <https://doi.org/10.1016/j.ejogrb.2025.114594>.
- [114] S. Bisch, R. Findley, C. Ince, M. Nardell, G. Nelson, Efficacy of pre-operative pharmacologic thromboprophylaxis on incidence of venous thromboembolism following major gynecologic and gynecologic oncology surgery: a systematic review and meta-analysis, *Int. J. Gynecol. Cancer* 31 (2) (2021) 257–264, <https://doi.org/10.1136/ijgc-2020-001991>.
- [115] P. Insin, K. Vitoopinyoparb, K. Thadanipon, C. Charakorn, J. Attia, G.J. McKay, A. Thakhsinian, Prevention of venous thromboembolism in gynecological cancer patients undergoing major abdominopelvic surgery: a systematic review and network meta-analysis, *Gynecol. Oncol.* 161 (1) (2021) 304–313, <https://doi.org/10.1016/j.ygyno.2021.01.027>.
- [116] M. Guo, L. Lu, Y. Sun, L. Li, M. Wu, J. Lang, Comprehensive functional exercises with patient education for the prevention of venous thrombosis after major gynecologic surgery: A randomized controlled study, *Thromb. Res.* 178 (2019) 69–74, <https://doi.org/10.1016/j.thromres.2019.04.013>.
- [117] K.A. Black, S. Bowden, P. Chu, C. McClurg, S. Pin, A. Metcalfe, Incidence of venous thromboembolism in patients with ovarian cancer receiving neoadjuvant chemotherapy: systematic review and meta-analysis, *Int. J. Gynecol. Cancer* 34 (6) (2024) 855–862, <https://doi.org/10.1136/ijgc-2023-005166>.
- [118] S.R. Guntupalli, A. Brennecke, K. Behbakht, A. Tayebnejad, C.A. Breed, L.M. Babayan, et al., Safety and efficacy of apixaban vs enoxaparin for preventing postoperative venous thromboembolism in women undergoing surgery for gynecologic malignant neoplasm: a randomized clinical trial, *JAMA Netw. Open* 3 (6) (2020), e207410, <https://doi.org/10.1001/jamanetworkopen.2020.7410>.
- [119] A. Shahbar, A. Alawliqi, A. Alhifany, A. Noor, A.R. Almutairi, M. Alnuhait, Safety and efficacy of direct oral anticoagulants apixaban and rivaroxaban versus standard therapy for VTE prophylaxis post cancer surgery—a network meta-analysis of randomized clinical trials, *J. Clin. Med.* 14 (6) (2025) 1811, <https://doi.org/10.3390/jcm14061811>.
- [120] A. Glickman, A. Brennecke, A. Tayebnejad, K. Matsuo, S.R. Guntupalli, J. Sheeder, Cost-effectiveness of apixaban for prevention of venous thromboembolic events in patients after gynecologic cancer surgery, *Gynecol. Oncol.* 159 (2) (2020) 476–482, <https://doi.org/10.1016/j.ygyno.2020.07.096>.
- [121] H. Chen, Y. Chen, A. Zheng, X. Tan, L. Han, Is pharmacologic venous Thromboprophylaxis necessary for patients undergoing minimally invasive surgery for endometrial Cancer? A systematic review and meta-analysis, *Gynecol. Oncol.* 188 (2024) 27–34, <https://doi.org/10.1016/j.ygyno.2024.06.006>.
- [122] L.I. Lavikainen, G.H. Guyatt, A.L. Luomaranta, R. Cartwright, I.E.J. Kalliala, R.J. Couban, et al., Risk of thrombosis and bleeding in gynecologic cancer surgery: systematic review and meta-analysis, *Am. J. Obstet. Gynecol.* 230 (4) (2024) 403–416, <https://doi.org/10.1016/j.ajog.2023.10.006>.
- [123] H. Fowler, J. Law, S.M. Tham, S.A. Gunaravi, N. Houghton, R.E. Clifford, et al., Impact on blood loss and transfusion rates following administration of tranexamic acid in major oncological abdominal and pelvic surgery: A systematic review and meta-analysis, *J. Surg. Oncol.* 126 (3) (2022) 609–621, <https://doi.org/10.1002/jso.26900>.
- [124] A. Zywoot, C.S.M. Lau, H.S. Fletcher, S. Paul, Bundles prevent surgical site infections after colorectal surgery: meta-analysis and systematic review, *J. Gastrointest. Surg.* 21 (2017) 1915–1930, <https://doi.org/10.1007/s11605-017-3465-3>.
- [125] M.B. Schiavone, L. Moukarzel, K. Leong, Q.C. Zhou, A.M. Afonso, A. Iasonos, et al., Surgical site infection reduction bundle in patients with gynecologic cancer undergoing colon surgery, *Gynecol. Oncol.* 147 (2017) 115–119, <https://doi.org/10.1016/j.ygyno.2017.07.010>.
- [126] S.A. Waits, D. Fritze, M. Banerjee, W. Zhang, J. Kubus, M.J. Englesbe, et al., Developing an argument for bundled interventions to reduce surgical site infection in colorectal surgery, *Surgery* 155 (2014) 602–606, <https://doi.org/10.1016/j.surg.2013.12.004>.
- [127] D.S. Kumar, S.N. Noushad, A. Sharma, M.P. Viswanathan, Effectiveness of ERAS protocol in gynaecological surgeries: experience at a tertiary care centre in India, *Indian J. Gynecol. Oncol.* 22 (2024) 35, <https://doi.org/10.1007/s40944-024-00805-0>.
- [128] A. Knisely, M.D. Iniesta, C.A. Marten, G. Chisholm, K.M. Schmeler, J.S. Taylor, Metronidazole and cefazolin vs cefazolin alone for surgical site infection prophylaxis in gynecologic surgery at a comprehensive cancer center, *Am. J. Obstet. Gynecol.* 231 (2024) 326.e1–326.e13, <https://doi.org/10.1016/j.ajog.2024.03.043>.
- [129] M. Gorman, A. Kredentser, I.A. Katehis, A. Alvarez, A. Williams, J. Silvestri, et al., Addition of metronidazole to standard-of-care perioperative prophylaxis at the time of hysterectomy for gynecologic malignancies, *Int. J. Gynecol. Cancer* 35 (2025), 102036, <https://doi.org/10.1016/j.ijgc.2025.102036>.
- [130] ACOG Practice Bulletin No. 195: Prevention of infection after gynecologic procedures, *Obstet. Gynecol.* 131 (2018) e172–e189, <https://doi.org/10.1097/AOG.0000000000002670>.
- [131] S.J. Berrios-Torres, C.A. Umscheid, D.W. Bratzler, B. Leas, E.C. Stone, R.R. Kelz, et al., Centers for Disease Control and Prevention guideline for the prevention of surgical site infection, 2017, *JAMA Surg.* 152 (2017) 784, <https://doi.org/10.1001/jamasurg.2017.0904>.
- [132] C.C. López, J.D. Villegas-Echeverri, J.F. De Los Rios, E.M. Vásquez-Trespalcacios, A. Arango, C. Cifuentes, et al., Metronidazole for prevention of pelvic cellulitis and abscess after laparoscopic hysterectomy: a triple-blinded, randomized, placebo-controlled clinical trial, *J. Minim. Invasive Gynecol.* 30 (2023) 912–918, <https://doi.org/10.1016/j.jmig.2023.07.007>.
- [133] B. Sousa-Pinto, K.G. Blumenthal, L. Courtney, C.M. Mancini, M.N. Jeffres, Assessment of the frequency of dual allergy to penicillins and cefazolin, *JAMA Surg.* 156 (2021), e210021, <https://doi.org/10.1001/jamasurg.2021.0021>.
- [134] K.M. Anstey, J.E. Anstey, S.B. Doernberg, L.-L. Chen, I.M. Otani, Perioperative use and safety of cephalosporin antibiotics in patients with documented penicillin allergy, *J. Allergy Clin. Immunol. Pract.* 9 (2021) 3203–3207.e1, <https://doi.org/10.1016/j.jaip.2021.03.017>.
- [135] K.G. Blumenthal, E.E. Ryan, Y. Li, H. Lee, J.L. Kuhlen, E.S. Shenoy, The impact of a reported penicillin allergy on surgical site infection risk, *Clin. Infect. Dis.* 66 (2018) 329–336, <https://doi.org/10.1093/cid/cix794>.
- [136] J.A. Trubiano, S. Vogrin, Chua KYL, J. Bourke, J. Yun, A. Douglas, et al., Development and validation of a penicillin allergy clinical decision rule, *JAMA Intern. Med.* 180 (5) (2020) 745–752.
- [137] M.H. Lippitt, M.G. Fairbairn, R. Matsuno, R.L. Stone, E.J. Tanner, E.C. Wick, et al., Outcomes associated with a five-point surgical site infection prevention bundle in women undergoing surgery for ovarian cancer, *Obstet. Gynecol.* 130 (2017) 756–764, <https://doi.org/10.1097/AOG.0000000000002213>.
- [138] R. Agarwal, A. Rajanbabu, P.V. Nitu, G. Goel, L. Madhusudan, U.G. Unnikrishnan, A prospective study evaluating the impact of implementing the ERAS protocol on patients undergoing surgery for advanced ovarian cancer, *Int. J. Gynecol. Cancer* 29 (2019) 605–612, <https://doi.org/10.1136/ijgc-2018-000043>.
- [139] H. Jalalzadeh, H. Groenen, D.R. Buis, Y.E. Dreissen, J.H. Goosen, F.F. Ijpma, et al., Efficacy of different preoperative skin antiseptics on the incidence of surgical site infections: a systematic review, GRADE assessment, and network meta-analysis, *Lancet Microbe.* 3 (2022) e762–e771, [https://doi.org/10.1016/S2666-5247\(22\)00187-2](https://doi.org/10.1016/S2666-5247(22)00187-2).
- [140] A.O. Ademuyiwa, A.O. Adisa, S. Bach, A. Bhangu, E. Harrison, J.A. Ingabire, et al., Alcohol chlorhexidine skin preparation or triclosan-coated sutures to reduce surgical site infection: a systematic review and meta-analysis of high-quality randomised controlled trials, *Lancet Infect. Dis.* 22 (2022) 1242–1251, [https://doi.org/10.1016/S1473-3099\(22\)00133-5](https://doi.org/10.1016/S1473-3099(22)00133-5).
- [141] E.H. Springel, X.-Y. Wang, V.M. Sarfoh, B.P. Stetzer, S.A. Weight, B.M. Mercer, A randomized open-label controlled trial of chlorhexidine-alcohol vs povidone-iodine for cesarean antiseptics: the CAPICA trial, *Am. J. Obstet. Gynecol.* 217 (2017) 463.e1–463.e8, <https://doi.org/10.1016/j.ajog.2017.05.060>.
- [142] U.P. Dior, S. Kathurusinghe, C. Cheng, C. Reddington, A.J. Daley, C. Ang, et al., Effect of surgical skin antiseptics on surgical site infections in patients undergoing gynecological laparoscopic surgery: a double-blind randomized clinical trial, *JAMA Surg.* 155 (2020) 807–815, <https://doi.org/10.1001/jamasurg.2020.1953>.
- [143] R.O. Darouiche, M.J. Wall, Itani KMF, M.F. Otterson, A.L. Webb, M.M. Carrick, et al., Chlorhexidine-alcohol versus povidone-iodine for surgical-site antiseptics, *N. Engl. J. Med.* 362 (2010) 18–26, <https://doi.org/10.1056/NEJMoa0810988>.
- [144] A.O. Ademuyiwa, P. Hardy, E. Runigamugabo, P. Sodonougbo, H. Behanzin, S. Kangni, et al., Reducing surgical site infections in low-income and middle-income countries (FALCON): a pragmatic, multicentre, stratified, randomised controlled trial, *Lancet* 398 (2021) 1687–1699, [https://doi.org/10.1016/S0140-6736\(21\)01548-8](https://doi.org/10.1016/S0140-6736(21)01548-8).
- [145] S. Uppal, A. Bazzi, R.K. Reynolds, J. Harris, M.D. Pearlman, D.A. Campbell, et al., Chlorhexidine-alcohol compared with povidone-iodine for preoperative topical antiseptics for abdominal hysterectomy, *Obstet. Gynecol.* 130 (2017) 319–327, <https://doi.org/10.1097/AOG.0000000000002130>.
- [146] S. Gezer, H.M. Yalvac, K. Güngör, İ. Yücesoy, Povidone-iodine vs chlorhexidine alcohol for skin preparation in malignant and premalignant gynaecologic diseases: a randomized controlled study, *Eur. J. Obstet. Gynecol. Reprod. Biol.* 244 (2020) 45–50, <https://doi.org/10.1016/j.ejogrb.2019.10.035>.
- [147] S.K. Rozycki, V. Nguyen, N. Miroballi, E.C. Rutledge, E.M. Balk, D.D. Antosh, Vaginal antiseptic preparation at the time of hysterectomy: a systematic review and meta-analysis, *Am. J. Obstet. Gynecol.* 232 (2025) 422–431.e4, <https://doi.org/10.1016/j.ajog.2024.12.031>.
- [148] E. Madrid, G. Urrutia, M. Roqué i Figuls, H. Pardo-Hernandez, J.M. Campos, P. Paniagua, et al., Active body surface warming systems for preventing complications caused by inadvertent perioperative hypothermia in adults, *Cochrane*

- Database Syst. Rev. 2016 (2016), CD009016, <https://doi.org/10.1002/14651858.CD009016.pub2>.
- [149] I. Balki, J.S. Khan, P. Staibano, E. Dupeppe, A. Bessissow, E.N. Sloan, et al., Effect of perioperative active body surface warming systems on analgesic and clinical outcomes: a systematic review and meta-analysis of randomized controlled trials, *Anesth. Analg.* 131 (2020) 1430–1443, <https://doi.org/10.1213/ANE.0000000000005145>.
- [150] R. Chen, Y. Du, L. Chen, Y. Bai, Y. Zhang, T. Yu, et al., The impact of perioperative hypothermia on surgical site infection risk: a meta-analysis, *BMC Anesthesiol.* (2025), 25, <https://doi.org/10.1186/s12871-025-03277-7>.
- [151] S. Fossum, J. Hays, M.M. Henson, A comparison study on the effects of prewarming patients in the outpatient surgery setting, *J. Perianesth. Nurs.* 16 (2001) 187–194, <https://doi.org/10.1053/jpan.2001.24039>.
- [152] G. Campbell, P. Alderson, A.F. Smith, S. Warttig, Warming of intravenous and irrigation fluids for preventing inadvertent perioperative hypothermia, *Cochrane Database Syst. Rev.* 2015 (2015), CD009891, <https://doi.org/10.1002/14651858.CD009891.pub2>.
- [153] T.D. Tubog, T.D. Kane, A.M. Ericksen, Combined forced air warming and warm intravenous fluid strategy for perioperative hypothermia in cesarean delivery: a systematic review and meta-analysis, *J. Perianesth. Nurs.* 38 (2023) 21–32, <https://doi.org/10.1016/j.jopan.2022.03.009>.
- [154] A. Kumar, D.P. Martin, S.R. Dhanorker, S.R. Brandt, D.R. Schroeder, A.C. Hanson, et al., Improving the rate of surgical normothermia in gynecologic surgery, *Gynecol. Oncol.* 154 (2019) 590–594, <https://doi.org/10.1016/j.ygyno.2019.06.027>.
- [155] A. Conway, M. Bittner, D. Phan, K. Chang, N. Kamboj, E. Tipton, et al., Accuracy and precision of zero-heat-flux temperature measurements with the 3M™ Bair Hugger™ Temperature Monitoring System: a systematic review and meta-analysis, *J. Clin. Monit. Comput.* 35 (1) (2021) 39–49, <https://doi.org/10.1007/s10877-020-00543-6>.
- [156] J. Jogie, J.A. Jogie, K. Phillip, Perioperative temperature monitoring in anesthesia: a review of current evidence and clinical practice, *Cureus* 18 (4) (2026), e107097, <https://doi.org/10.7759/cureus.107097>.
- [157] K.S. Gurusamy, C.D. Toon, B.R. Davidson, Subcutaneous closure versus no subcutaneous closure after non-Caesarean surgical procedures, *Cochrane Database Syst. Rev.* 2014 (2014), CD010425, <https://doi.org/10.1002/14651858.CD010425.pub2>.
- [158] V. Pergialiotis, A. Prodromidou, D. Perrea, S. Doumouchtsis, The impact of subcutaneous tissue suturing at caesarean section on wound complications: a meta-analysis, *BJOG* 124 (2017) 1018–1025, <https://doi.org/10.1111/1471-0528.14593>.
- [159] A.D. Altman, M. Robert, R. Armbrust, W.J. Fawcett, M. Nihira, C.N. Jones, et al., Guidelines for vulvar and vaginal surgery: Enhanced Recovery After Surgery Society recommendations, *Am. J. Obstet. Gynecol.* 223 (2020) 475–485, <https://doi.org/10.1016/j.ajog.2020.07.039>.
- [160] T. Ishinuki, H. Shinkawa, K. Kouzu, S. Shinji, E. Goda, T. Ohyanagi, et al., Recent evidence for subcutaneous drains to prevent surgical site infections after abdominal surgery: a systematic review and meta-analysis, *World J Gastrointest Surg.* 15 (2023) 2879–2889, <https://doi.org/10.4240/wjgs.v15.i12.2879>.
- [161] C.H. Choi, N.K. Kim, K. Kim, Y.J. Lee, K.H. Lee, J.-M. Lee, et al., Effects of subcutaneous drain on wound dehiscence and infection in gynecological midline laparotomy: secondary analysis of a Korean Gynecologic Oncology Group study (KGOG 4001), *Eur. J. Surg. Oncol.* 50 (2024), 108484, <https://doi.org/10.1016/j.ejso.2024.108484>.
- [162] H. Groenen, N. Bontekoning, H. Jalalzadeh, D.R. Buis, Y.E.M. Dreissen, J.H.M. Goosen, et al., Incisional wound irrigation for the prevention of surgical site infection, *JAMA Surg.* 159 (2024) 792, <https://doi.org/10.1001/jamasurg.2024.0775>.
- [163] L.M. Kuroki, M.M. Mullen, L.S. Massad, N. Wu, J. Liu, D.G. Mutch, et al., Wound complication rates after staples or suture for midline vertical skin closure in obese women, *Obstet. Gynecol.* 130 (2017) 91–99, <https://doi.org/10.1097/AOG.0000000000002061>.
- [164] M.M. Leitao, Q.C. Zhou, M.B. Schiavone, R.A. Cowan, E.S. Smith, A. Iasonos, et al., Prophylactic negative pressure wound therapy after laparotomy for gynecologic surgery, *Obstet. Gynecol.* 137 (2021) 334–341, <https://doi.org/10.1097/AOG.0000000000004243>.
- [165] M. Frountzas, I. Karavolias, C. Nikolaou, O. Toutouza, V. Pergialiotis, K.G. Toutouzas, The impact of prophylactic negative wound pressure treatment (NWPT) on surgical site occurrences after gynecologic cancer surgery: a meta-analysis of randomized controlled and observational cohort studies, *Cancers (Basel)* 17 (2025), 1717, <https://doi.org/10.3390/cancers17101717>.
- [166] A.N. Al-Niimi, M. Ahmed, N. Burish, S.A. Chackmakchy, S. Seo, S. Rose, et al., Intensive postoperative glucose control reduces the surgical site infection rates in gynecologic oncology patients, *Gynecol. Oncol.* 136 (1) (2015) 71–76, <https://doi.org/10.1016/j.ygyno.2014.09.013>.
- [167] L. Hopkins, J. Brown-Broderick, J. Hearn, J. Malcolm, J. Chan, W. Hicks-Boucher, et al., Implementation of a referral to discharge glycemic control initiative for reduction of surgical site infections in gynecologic oncology patients, *Gynecol. Oncol.* 146 (2) (2017) 228–233, <https://doi.org/10.1016/j.ygyno.2017.05.021>.
- [168] C.E. Jones, L.A. Graham, M.S. Morris, J.S. Richman, R.H. Hollis, T.S. Wahl, et al., Association between preoperative hemoglobin A1c levels, postoperative hyperglycemia, and readmissions following gastrointestinal surgery, *JAMA Surg.* 152 (11) (2017) 1031–1038, <https://doi.org/10.1001/jamasurg.2017.2350>.
- [169] W. van den Boom, R.A. Schroeder, M.W. Manning, T.L. Setji, G.O. Fiestan, D.B. Dunson, Effect of A1C and glucose on postoperative mortality in noncardiac and cardiac surgeries, *Diabetes Care* 41 (4) (2018) 782–788, <https://doi.org/10.2337/dc17-2232>.
- [170] M. Kotagal, R.G. Symons, I.B. Hirsch, G.E. Umpierrez, E.P. Dellinger, E.T. Farrokhi, et al., SCOAP-CERTAIN Collaborative. Perioperative hyperglycemia and risk of adverse events among patients with and without diabetes, *Ann. Surg.* 261 (1) (2015) 97–103, <https://doi.org/10.1097/SLA.0000000000000688>.
- [171] J.Y. Chen, H. Nassereldine, S.B. Cook, L.W. Thornblade, E.P. Dellinger, D.R. Flum, Paradoxical association of hyperglycemia and surgical complications among patients with and without diabetes, *JAMA Surg.* 157 (9) (2022) 765–770, <https://doi.org/10.1001/jamasurg.2021.5561>.
- [172] M. Gao, M. Chen, G. Dai, D. Zhu, Y. Cai, Clinical study: the impact of goal-directed fluid therapy on volume management during enhanced recovery after surgery in gastrointestinal procedures, *Acta Biochim. Pol.* 71 (2024), 12377, <https://doi.org/10.3389/abp.2024.12377>.
- [173] G.G. Ovsak, G.E. Mena, J.D. Lasala, Intraoperative management for enhanced recovery after gynecologic surgery, *Clin. Obstet. Gynecol.* 68 (4) (2025) 491–500, <https://doi.org/10.1097/GRF.0000000000000975>.
- [174] G.E. Mena, A. Zorrilla-Vaca, A. Vaporciyan, R. Mehran, J.D. Lasala, W. Williams, et al., Intraoperative dexmedetomidine and ketamine infusions in an enhanced recovery after thoracic surgery program: a propensity score matched analysis, *J. Cardiothorac. Vasc. Anesth.* 36 (4) (2022) 1064–1072, <https://doi.org/10.1053/j.jvca.2021.09.038>.
- [175] M.S. Mustafa, M.A. Shafique, M. Tabassum, H.A.U. Rahman, A.M. Syed, K. Kumar, et al., Efficacy and safety of intravenous lidocaine infusion in postoperative pain management and surgical outcomes following laparoscopic colorectal surgery: a meta-analysis, *Curr. Probl. Surg.* 61 (8) (2024), 101544, <https://doi.org/10.1016/j.cpsurg.2024.101544>.
- [176] W. Hannan, E. Yates, G.E. Mena, E. Rutledge, K. Christensen, G. Flores, et al., Use of quadratus lumborum block in gynecologic procedures, *Int. J. Gynecol. Cancer* 35 (4) (2025), 101629, <https://doi.org/10.1016/j.ijgc.2025.101629>.
- [177] J.H. Shin, E.M. Balk, K. Gritsenko, A. Wang, K. Plewniak, N. Shaparin, Transversus abdominis plane block for laparoscopic hysterectomy pain: a meta-analysis, *JSLS* 24 (2) (2020), e2020.00018, <https://doi.org/10.4293/JSLS.2020.00018>.
- [178] J. Zeng, A. Hong, Z. Gu, J. Jian, X. Liang, Efficacy of transversus abdominis plane block on postoperative nausea and vomiting: a meta-analysis of randomized controlled trial, *BMC Anesthesiol.* 24 (1) (2024) 87, <https://doi.org/10.1186/s12871-024-02469-x>.
- [179] O. Baran, A. Şahin, C. Arar, Comparative efficacy of erector spinae plane and quadratus lumborum blocks in managing postoperative pain for total abdominal hysterectomy: a randomized controlled trial, *Medicine (Baltimore)* 103 (43) (2024), e40313, <https://doi.org/10.1097/MD.00000000000040313>.
- [180] N.K. Yousef, Quadratus lumborum block versus transversus abdominis plane block in patients undergoing total abdominal hysterectomy: a randomized prospective controlled trial, *Anesth Essays Res.* 12 (3) (2018) 742–747, https://doi.org/10.4103/aer.AER_108_18.
- [181] U. Shukla, U. Yadav, J. Duggal, A comparative study of ultrasound-guided quadratus lumborum block and transversus abdominis plane block for postoperative analgesia following total abdominal hysterectomy, *Cureus* 15 (3) (2023), e36412, <https://doi.org/10.7759/cureus.36412>.
- [182] N. Singh, P.B. Rao, A. Elayat, Ultrasound-guided anterior and posterior quadratus lumborum block for analgesia after laparoscopic hysterectomy, *Pain Manag.* 11 (1) (2021) 5–8, <https://doi.org/10.2217/pmt-2020-0008>.
- [183] H. She, Y. Qin, W. Peng, Y. Zhou, Y. Dai, Y. Wang, et al., Anterior Quadratus Lumborum block for total laparoscopic hysterectomy: a randomized, double-blind, placebo-controlled trial, *Clin. J. Pain* 39 (11) (2023) 571–579, <https://doi.org/10.1097/AJP.0000000000001156>.
- [184] L. Huang, L. Zheng, J. Zhang, X. Zhu, L. Pan, Y. Zhang, et al., Transmuscular quadratus lumborum block versus oblique subcostal transversus abdominis plane block for analgesia in laparoscopic hysterectomy: a randomised single-blind trial, *BMJ Open* 11 (8) (2021), e043883, <https://doi.org/10.1136/bmjopen-2020-043883>.
- [185] J. Ishio, N. Komasa, H. Kido, T. Minami, Evaluation of ultrasound-guided posterior quadratus lumborum block for postoperative analgesia after laparoscopic gynecologic surgery, *J. Clin. Anesth.* 41 (2017) 1–4, <https://doi.org/10.1016/j.jclinane.2017.05.015>.
- [186] L. Huang, Y. Cai, L. Yang, L. Liu, Q. Wang, K. Shi, Ultrasound-guided anterior quadratus lumborum block at the L2 level for postsurgical analgesia in patients undergoing laparoscopic gynaecological surgery: a single-centre, randomised, double-blinded trial at a university-affiliated hospital in China, *BMJ Open* 13 (10) (2023), e073917, <https://doi.org/10.1136/bmjopen-2023-073917>.
- [187] A. Jadon, A. Ahmad, R.K. Sahoo, N. Sinha, S. Chakraborty, A. Bakshi, Efficacy of transmuscular quadratus lumborum block in the multimodal regimen for postoperative analgesia after total laparoscopic hysterectomy: A prospective randomised double-blinded study, *Indian J. Anaesth.* 65 (5) (2021) 362–368, https://doi.org/10.4103/ija.IJA_1258_20.
- [188] N. Pejić, R. Mitić, N. Sadana, I. Veličković, Interfascial plane blocks in obstetric and gynecologic surgery, *Acta Clin. Croat.* 61 (Suppl. 2) (2022) 145–150, <https://doi.org/10.20471/acc.2022.61.s2.19>.
- [189] S. Naaz, R. Kumar, E. Ozair, N. Sahay, A. Asghar, S. Jha, et al., Ultrasound guided Quadratus Lumborum block versus Transversus Abdominis Plane block for postoperative analgesia in patients undergoing total abdominal hysterectomy, *Turk. J. Anaesthesiol. Reanim.* 49 (5) (2021) 357–364, <https://doi.org/10.5152/TJAR.2021.985>.
- [190] Y.J. Bang, E.K. Lee, H. Jeong, R. Kang, J.S. Ko, T.S. Hahm, et al., Analgesic efficacy of erector spinae plane block in patients undergoing major gynecologic surgery: A randomized controlled study, *J. Clin. Anesth.* 93 (2024), 111362, <https://doi.org/10.1016/j.jclinane.2023.111362>.
- [191] P. Dilisiz, İ. Gökbel, Y. Umutlu, H.A. Ertuğrul, S. Sari, Effect of erector spinae plane block and transversus abdominis plane block on quality of recovery and postoperative pain after laparoscopic hysterectomy; randomized, double-blinded clinical trial, *J. Obstet. Gynaecol. Res.* 51 (4) (2025), e16284, <https://doi.org/10.1111/jog.16284>.

- [192] A.A.F. Kamel, O.A.I. Amin, M.A.M. Ibrahim, Bilateral ultrasound-guided erector spinae plane block versus transversus abdominis plane block on postoperative analgesia after total abdominal hysterectomy, *Pain Physician* 23 (4) (2020) 375–382.
- [193] D. Chiumello, S. Coppola, I. Fratti, M. Leone, B. Pastene, Ventilation strategy during urological and gynaecological robotic-assisted surgery: a narrative review, *Br. J. Anaesth.* 131 (4) (2023) 764–774, <https://doi.org/10.1016/j.bja.2023.06.066>.
- [194] Z. Hollo, S. McKenzie, R. Kluger, et al., The effect of restrictive compared to liberal intravenous fluid volume on hypotension in adults undergoing major abdominal surgery, *Sci. Rep.* 14 (1) (2024) 14401, <https://doi.org/10.1038/s41598-024-65031-2>.
- [195] M.G. Desale, E.J. Tanner, A.K. Sinno, et al., Perioperative fluid status and surgical outcomes in patients undergoing cytoreductive surgery for advanced epithelial ovarian cancer, *Gynecol. Oncol.* 144 (1) (2017) 61–64, <https://doi.org/10.1016/j.ygyno.2016.10.027>.
- [196] E. Hasselgren, D. Hertzberg, T. Camderman, H. Björne, S. Salehi, Perioperative fluid balance and major postoperative complications in surgery for advanced epithelial ovarian cancer, *Gynecol. Oncol.* 161 (2) (2021) 402–407, <https://doi.org/10.1016/j.ygyno.2021.02.034>.
- [197] S.E. Regenbogen, N.J. Shah, S.D. Collins, et al., Population-based assessment of intraoperative fluid administration practices across three surgical specialties, *Ann. Surg.* 265 (5) (2017) 930–940, <https://doi.org/10.1097/SLA.0000000000001745>.
- [198] J. Peng, R. Dong, J. Jiao, et al., Enhanced recovery after surgery impact on the systemic inflammatory response of patients following gynecological oncology surgery: a prospective randomized study, *Cancer Manag. Res.* 13 (2021) 4383–4392, <https://doi.org/10.2147/CMAR.S294718>.
- [199] M. Lilot, J.M. Ehrenfeld, C. Lee, et al., Variability in practice and factors predictive of total crystalloid administration during abdominal surgery: retrospective two-centre analysis, *Br. J. Anaesth.* 114 (5) (2015) 767–776, <https://doi.org/10.1093/bja/aeu452>.
- [200] F. Michard, The burden of high-risk surgery and the potential benefit of goal-directed strategies, *Crit. Care* 15 (5) (2011) 447, <https://doi.org/10.1186/cc10473>.
- [201] R. Pearse, D. Dawson, J. Fawcett, et al., Early goal-directed therapy after major surgery reduces complications and duration of hospital stay. A randomised, controlled trial [ISRCTN38797445], *Crit. Care* 9 (6) (2005), R687, <https://doi.org/10.1186/cc3887>.
- [202] E. Kalogera, G. Nelson, J. Liu, et al., Surgical technical evidence review for gynecologic surgery conducted for the Agency for Healthcare Research and Quality Safety Program for Improving Surgical Care and Recovery, *Am. J. Obstet. Gynecol.* 219 (6) (2018) 563.e1–563.e19, <https://doi.org/10.1016/j.ajog.2018.07.014>.
- [203] J. Goswami, A.R. Pal, S.M. Barman, et al., Restrictive versus goal-directed fluid replacement strategy in ovarian cancer cytoreductive surgery (RiGoROCS): A randomised controlled trial, *Indian J. Anaesth.* 67 (12) (2023) 1101–1109, https://doi.org/10.4103/ijai.489_23.
- [204] L. Frassanito, P.P. Giuri, F. Vassalli, et al., Hypotension prediction index guided goal directed therapy and the amount of hypotension during major gynaecologic oncologic surgery: a randomized controlled clinical trial, *J. Clin. Monit. Comput.* 37 (4) (2023) 1081–1093, <https://doi.org/10.1007/s10877-023-01017-1>.
- [205] G.O. Yildiz, G.O. Hergusl, G. Sertcakacilar, et al., Perioperative goal-directed fluid management using noninvasive hemodynamic monitoring in gynecologic oncology, *Braz. J. Anesthesiol. (Engl Ed)* 72 (3) (2022) 322–330, <https://doi.org/10.1016/j.bjane.2021.12.012>.
- [206] Z. Jin, A. Razak, H. Huang, et al., Intraoperative goal-directed fluid therapy and outcomes after oncologic surgeries: a systematic review and meta-analysis, *Anesth. Analg.* 140 (4) (2025) 821–832, <https://doi.org/10.1213/ANE.0000000000007277>.
- [207] D.S. Ramsingh, C. Sanghvi, J. Gamboa, M. Cannesson, R.L. Applegate, Outcome impact of goal directed fluid therapy during high risk abdominal surgery in low to moderate risk patients: a randomized controlled trial, *J. Clin. Monit. Comput.* 27 (3) (2013) 249–257, <https://doi.org/10.1007/s10877-012-9422-5>.
- [208] Y. Sun, X. Liang, F. Chai, D. Shi, Y. Wang, Goal-directed fluid therapy using stroke volume variation on length of stay and postoperative gastrointestinal function after major abdominal surgery—a randomized controlled trial, *BMC Anesthesiol.* 23 (1) (2023) 397, <https://doi.org/10.1186/s12871-023-02360-1>.
- [209] J.Y. Nicklas, O. Diener, M. Leistenschneider, et al., Personalised haemodynamic management targeting baseline cardiac index in high-risk patients undergoing major abdominal surgery: a randomised single-centre clinical trial, *Br. J. Anaesth.* 125 (2) (2020) 122–132, <https://doi.org/10.1016/j.bja.2020.04.094>.
- [210] E.K. Egger, J. Ullmann, T. Hilbert, et al., Intraoperative fluid balance and perioperative complications in ovarian cancer surgery, *Ann. Surg. Oncol.* 31 (13) (2024) 8944–8951, <https://doi.org/10.1245/s10434-024-16246-0>.
- [211] J. Yu, L. Che, A. Zhu, L. Xu, Y. Huang, Goal-directed intraoperative fluid therapy benefits patients undergoing major gynecologic oncology surgery: a controlled before-and-after study, *Front. Oncol.* 12 (2022), 833273, <https://doi.org/10.3389/fonc.2022.833273>.
- [212] S.C. Modesitt, B.M. Sarosiek, E.R. Trowbridge, et al., Enhanced recovery implementation in major gynecologic surgeries: effect of care standardization, *Obstet. Gynecol.* 128 (3) (2016) 457–466, <https://doi.org/10.1097/AOG.0000000000001555>.
- [213] Y. Yuan, Q. Tan, Y. Chen, K. Zhu, B. Pan, B. Liu, et al., Different surgical methods of hysterectomy for the management of endometrial cancer: a systematic review and network meta-analysis, *Front. Oncol.* 14 (2025), 1524991, <https://doi.org/10.3389/fonc.2024.1524991>.
- [214] G. Dinoi, K. Ghoniem, M.H. Murad, B. Segarra-Vidal, V. Zanfagnin, P.J. Coronado, et al., Minimally invasive compared with open surgery in high-risk endometrial cancer: a systematic review and meta-analysis, *Obstet. Gynecol.* 141 (1) (2023) 59–68, <https://doi.org/10.1097/AOG.0000000000004995>.
- [215] P.T. Ramirez, K.P. Robledo, M. Frumovitz, R. Pareja, R. Ribeiro, A. Lopez, et al., LACC Trial: final analysis on overall survival comparing open versus minimally invasive radical hysterectomy for early-stage cervical cancer, *J. Clin. Oncol.* 42 (23) (2024) 2741–2746, <https://doi.org/10.1200/JCO.2023.23.02335>.
- [216] A. Melamed, D.J. Margul, L. Chen, N.L. Keating, M.G. Del Carmen, J. Yang, et al., Survival after minimally invasive radical hysterectomy for early-stage cervical cancer, *N. Engl. J. Med.* 379 (20) (2018) 1905–1914, <https://doi.org/10.1056/NEJMoa1804923> (Epub 2018 Oct 31).
- [217] M. Frumovitz, A. Obermair, R.L. Coleman, R. Pareja, A. Lopez, R. Ribero, et al., Quality of life in patients with cervical cancer after open versus minimally invasive radical hysterectomy (LACC): a secondary outcome of a multicentre, randomised, open-label, phase 3, non-inferiority trial, *Lancet Oncol.* 21 (6) (2020) 851–860, [https://doi.org/10.1016/S1470-2045\(20\)300814](https://doi.org/10.1016/S1470-2045(20)300814).
- [218] A. Yokoi, H. Machida, M. Shimada, K. Matsuo, S. Shigeta, S. Furukawa, et al., Efficacy and safety of minimally invasive surgery versus open laparotomy for epithelial ovarian cancer: A systematic review and meta-analysis, *Gynecol. Oncol.* 190 (2024) 42–52, <https://doi.org/10.1016/j.ygyno.2024.08.011>.
- [219] J.A. Rauh-Hain, A. Melamed, R. Pareja, T. May, A. Sinno, L. McNally, et al., Laparoscopic cytoreduction after neoadjuvant chemotherapy in high-grade epithelial ovarian cancer: a LANCE randomized clinical trial, *JAMA Netw. Open* 7 (11) (2024), e2446325, <https://doi.org/10.1001/jamanetworkopen.2024.46325>.
- [220] C. Pomel, C. Akladios, E. Lambaudie, R. Rouzier, G. Ferron, F. Lecuru, et al., Laparoscopic management of advanced epithelial ovarian cancer after neoadjuvant chemotherapy: a phase II prospective multicenter non-randomized trial (the CLOVE study), *Int. J. Gynecol. Cancer* 31 (12) (2021) 1572–1578, <https://doi.org/10.1136/ijgc-2021-002888>.
- [221] C. Uwins, H. Assalaarachchi, K. Bennett, J. Read, A. Taylor, J. Crawshaw, et al., MIR-RORS: a prospective cohort study assessing the feasibility of robotic interval debulking surgery for advanced-stage ovarian cancer, *Int. J. Gynecol. Cancer* 34 (6) (2024) 886–897, <https://doi.org/10.1136/ijgc-2024-005265>.
- [222] E.E. Dörmöz, Z. Büttin, E. Kardas, F. Vural, The outcomes of the 5 mm versus 11 mm primary trocar in gynecologic surgery - randomised study, *Ginekol. Pol.* 96 (6) (2025) 496–502, <https://doi.org/10.5603/gpl.100621>.
- [223] K. Bouattour, C. Louis-Sylvestre, R. Berry, Y. Levy-Zauberman, J.M. Lacombe, M. Cherruault, et al., Recovery after low-impact laparoscopic hysterectomy: a randomized controlled clinical trial, *Am. J. Obstet. Gynecol.* 234 (2) (2026) 449–460, <https://doi.org/10.1016/j.ajog.2025.08.090>.
- [224] S. Uccella, M. Malzoni, A. Cromi, R. Seracchioli, G. Ciravolo, F. Fanfani, et al., Laparoscopic vs transvaginal cuff closure after total laparoscopic hysterectomy: a randomized trial by the Italian Society of Gynecologic Endoscopy, *Am. J. Obstet. Gynecol.* 218 (5) (2018) 500.e1–500.e13, <https://doi.org/10.1016/j.ajog.2018.01.029>.
- [225] M. Davis, K. Barletta, A. Ford, R. Nitecki, K.M. Elias, R. Berkowitz, et al., The impact of post-operative voiding trial on length of stay following laparoscopic hysterectomy: a prospective, randomized control trial, *Eur. J. Gynaecol. Oncol.* 42 (1) (2021) 110–117.
- [226] M. Le Neveu, J. Davis, R. Nicholson, E.K. Gough, S. Xie, K. Patzkowsky, et al., Reevaluating the requirement to void following minimally invasive hysterectomy: a randomized controlled trial, *Am. J. Obstet. Gynecol.* 233 (1) (2025) e11–e15, <https://doi.org/10.1016/j.ajog.2025.03.038>.
- [227] J. Mathesaytis, P. Trudeau, S. Bisch, S. Pin, M. Chong, G. Nelson, Improving the rate of same-day discharge in gynecologic oncology patients undergoing minimally invasive surgery—an enhanced recovery after surgery quality improvement initiative, *J. Minim. Invasive Gynecol.* 31 (4) (2024) 309–320, <https://doi.org/10.1016/j.jmig.2024.01.015>.
- [228] A. Peters, N. Siripong, L. Wang, N.M. Donnellan, Enhanced recovery after surgery outcomes in minimally invasive nonhysterectomy gynecologic procedures, *Am. J. Obstet. Gynecol.* 223 (2) (2020) 234.e1–234.e8, <https://doi.org/10.1016/j.ajog.2020.02.008>.
- [229] J.M. Patterson, M. Freeman, L.C. Hickman, Postoperative enhanced recovery after surgery pathways in gynecologic surgery, *Clin. Obstet. Gynecol.* 68 (4) (2025) 501–507, <https://doi.org/10.1097/GRF.0000000000000976>.
- [230] Y. Ren, D. Sun, L. Pei, X. Liu, Y. Liu, H. Liu, A full enhanced recovery after surgery program in gynecologic laparoscopic procedures: a randomized controlled trial, *J. Minim. Invasive Gynecol.* 28 (9) (2021) 1610–1617.e6, <https://doi.org/10.1016/j.jmig.2021.01.024>.
- [231] F. Ferrari, S. Forte, N. Sbalzer, V. Zizioli, M. Mauri, C. Maggi, E. Sartori, F. Odicino, Validation of an enhanced recovery after surgery protocol in gynecologic surgery: an Italian randomized study, *Am. J. Obstet. Gynecol.* 223 (4) (2020) 543.e1–543.e14, <https://doi.org/10.1016/j.ajog.2020.07.003>.
- [232] A. Horn, K. Kaneshiro, B.C.H. Tsui, Preemptive and preventive pain psychoeducation and its potential application as a multimodal perioperative pain control option: a systematic review, *Anesth. Analg.* 130 (3) (2020) 559–573, <https://doi.org/10.1213/ANE.0000000000004319>.
- [233] G.E. Glaser, E. Kalogera, A. Kumar, J. Yi, C. Destephano, D. Ubl, et al., Outcomes and patient perspectives following implementation of tiered opioid prescription guidelines in gynecologic surgery, *Gynecol. Oncol.* 157 (2) (2020) 476–481, <https://doi.org/10.1016/j.ygyno.2020.02.025>.
- [234] K.A. Matteson, M.O. Schimpf, P.C. Jeppson, J.C. Thompson, R.B. Gala, S. Balgobin, et al., Society of gynecologic surgeons systematic review group. Prescription opioid use for acute pain and persistent opioid use after gynecologic surgery: a systematic review, *Obstet. Gynecol.* 141 (4) (2023) 681–696, <https://doi.org/10.1097/AOG.0000000000005104>.
- [235] M.S. Basabe, T.S. Suki, M.F. Munsell, M.D. Iniesta, J.E. Garcia Lopez, R.T. Hillman, et al., Evaluation of a tiered opioid prescription algorithm in an ERAS pathway: exploring opportunities for further refinement, *Int. J. Gynecol. Cancer* 34 (2) (2024) 251–259, <https://doi.org/10.1136/ijgc-2023-004948>.

- [236] B. Margolis, L. Andriani, K. Baumann, A.M. Hirsch, B. Pothuri, Safety and feasibility of discharge without an opioid prescription for patients undergoing gynecologic surgery, *Obstet. Gynecol.* 136 (6) (2020) 1126–1134, <https://doi.org/10.1097/AOG.0000000000004158>.
- [237] J.M. Selle, D.M. Strozza, M.E. Branda, J.B. Gebhart, E.C. Trabuco, J.A. Occhino, et al., A bundle of opioid-sparing strategies to eliminate routine opioid prescribing in a urogynecology practice, *Am. J. Obstet. Gynecol.* 231 (2) (2024) 278.e1–278.e17, <https://doi.org/10.1016/j.jag.2024.05.043>.
- [238] J. Mark, D.M. Argentieri, C.A. Gutierrez, K. Morrell, K. Eng, A.D. Hutson, et al., Ultrarestrictive opioid prescription protocol for pain management after gynecologic and abdominal surgery, *JAMA Netw. Open* 1 (8) (2018), e185452, <https://doi.org/10.1001/jamanetworkopen.2018.5452>.
- [239] R.T. Hillman, M.D. Iniesta, Q. Shi, T. Suki, T. Chen, K. Cain, et al., Longitudinal patient-reported outcomes and restrictive opioid prescribing after minimally invasive gynecologic surgery, *Int. J. Gynecol. Cancer* 31 (1) (2021) 114–121, <https://doi.org/10.1136/ijgc-2020-002103>.
- [240] A. Pandraklakis, D. Haidopoulos, T. Lappas, E. Stamatakis, D. Valsamidis, M.D. Oikonomou, et al., Thoracic epidural analgesia as part of an enhanced recovery program in gynecologic oncology: a prospective cohort study, *Int. J. Gynecol. Cancer* 33 (11) (2023) 1794–1799, <https://doi.org/10.1136/ijgc-2023-004621>.
- [241] E. Kalogera, J.N. Bakkum-Gomez, A.L. Weaver, J.P. Moriarty, B.J. Borah, C.L. Langstraat, et al., Abdominal incision injection of liposomal bupivacaine and opioid use after laparotomy for gynecologic malignancies, *Obstet. Gynecol.* 128 (5) (2016) 1009–1017, <https://doi.org/10.1097/AOG.0000000000001719>.
- [242] S. Alsamman, D.M. Haas, I. Patanwala, D.A. Klein, K. Kasper, C.M. Pickett, Transversus abdominis plane (TAP) blocks for prevention of postoperative pain in women undergoing laparoscopic and robotic gynaecological surgery, *Cochrane Database Syst. Rev.* 4 (4) (2025), CD015145, <https://doi.org/10.1002/14651858.CD015145.pub2>.
- [243] F.A. Ferrari, B. Crestani, L. Torroni, M. Pavone, F. Ferrari, N. Bourdel, et al., Wound infiltration with local anesthetics versus transversus abdominis plane block for postoperative pain management in gynecological surgery: a systematic review and meta-analysis of randomized controlled trials, *J. Minim. Invasive Gynecol.* 32 (3) (2025) 229–239.e3, <https://doi.org/10.1016/j.jmig.2024.10.030>.
- [244] L.A. Meyer, C. Corzo, M.D. Iniesta, M. Munsell, Q. Shi, B. Pitcher, et al., A prospective randomized trial comparing liposomal bupivacaine vs standard bupivacaine wound infiltration in open gynecologic surgery on an enhanced recovery pathway, *Am. J. Obstet. Gynecol.* 224 (1) (2021) 70 e1–70 e11, <https://doi.org/10.1016/j.ajog.2020.07.017>.
- [245] S.A. Ostby, D. Narasimulu, M.A. Ochs Kinney, W. Cliby, C. Langstraat, J.N. Bakkum-Gomez, et al., Defining optimal perioperative analgesia in patients undergoing laparotomy for advanced gynecologic malignancy: a randomized controlled trial, *Gynecol. Oncol.* 190 (2024) 11–17, <https://doi.org/10.1016/j.ygyno.2024.08.002>.
- [246] D. Mehta, V. Thomas, J. Johnson, B. Scott, S. Cortina, L. Berger, Continuation of buprenorphine to facilitate postoperative pain management for patients on buprenorphine opioid agonist therapy, *Pain Physician* 23 (2) (2020) E163–E174.
- [247] T.R. Hickey, G.P.A. Costa, D. Oliveira, A. Podosek, A. Abelleira, V.J. Avila-Quintero, et al., Buprenorphine versus full agonist opioids for acute postoperative pain management: a systematic review and meta-analysis of randomized controlled trials, *Reg. Anesth. Pain Med.* 51 (1) (2026) 1–16, <https://doi.org/10.1136/rapm-2024-106014>.
- [248] T. Bertoch, D. D'Annunzio, J. McCoun, D. Solanki, L. Taber, J. Urban, et al., Suzetrigine, a nonopioid Na V 1.8 inhibitor for treatment of moderate-to-severe acute pain: two phase 3 randomized clinical trials, *Anesthesiology* 142 (6) (2025) 1085–1099, <https://doi.org/10.1097/ALN.00000000000005460>.
- [249] S. Huepenbecker, M.C. Santia, R. Harrison, R. Dos Reis, R. Pareja, M.D. Iniesta, et al., Impact of timing of urinary catheter removal on voiding dysfunction after radical hysterectomy for early cervical cancer, *Int. J. Gynecol. Cancer* 32 (8) (2022) 986–992, <https://doi.org/10.1136/ijgc-2022-003654>.
- [250] K. Gaballa, A. Denewer, A. Khater, V. Gallotta, C. Conte, A. Federico, et al., Feasibility of early postoperative bladder catheter removal without prior bladder-training exercises after laparoscopic nerve sparing radical hysterectomy, *J. Obstet. Gynaecol.* 39 (6) (2019) 788–792, <https://doi.org/10.1080/01443615.2019.1584883>.
- [251] P. Campbell, M. Casement, S. Addley, S. Dobbs, I. Harley, H. Nagar, Early catheter removal following laparoscopic radical hysterectomy for cervical cancer: assessment of a new bladder care protocol, *J. Obstet. Gynaecol.* 37 (7) (2017) 970–972, <https://doi.org/10.1080/01443615.2017.1328668>.
- [252] M.F. Mengatto, B.G.R. Castro, L. Nobrega, M.A. Vieira, C.E.M.C. Andrade, A.T. Tsunoda, et al., Early removal of indwelling urinary catheter after radical surgery for early-stage cervical cancer-A cohort study, *J. Surg. Oncol.* 122 (7) (2020) 1498–1505, <https://doi.org/10.1002/jso.26167>.
- [253] I. Zapardiel, R. Kocian, C. Köhler, J. Klat, A. Germanova, A. Jacob, et al., Voiding recovery after radical parametrectomy in cervical cancer patients: an international prospective multicentre trial - SENTIX, *Gynecol. Oncol.* 160 (3) (2021) 729–734, <https://doi.org/10.1016/j.ygyno.2020.12.018>.
- [254] Best practices Guidelines: Management of Genitourinary Injuries, https://www.facs.org/media/ya5hcu0s/genitourinary_guidelines.pdf 2025.
- [255] C.M. Harper, Y.M. Lyles, Physiology and complications of bed rest, *J. Am. Geriatr. Soc.* 36 (11) (1988) 1047–1054, <https://doi.org/10.1111/j.1532-5415.1988.tb04375.x>.
- [256] W. Alazawi, N. Pirmadjid, R. Lahiri, S. Bhattacharya, Inflammatory and immune responses to surgery and their clinical impact, *Ann. Surg.* 264 (1) (2016) 73–80, <https://doi.org/10.1097/SLA.0000000000001691>.
- [257] R.G. Brower, Consequences of bed rest, *Crit. Care Med.* 37 (10 Suppl) (2009) S422–S428.
- [258] C.Y. Ni, Z.H. Wang, Z.P. Huang, H. Zhou, L.J. Fu, H. Cai, et al., Early enforced mobilization after liver resection: A prospective randomized controlled trial, *Int. J. Surg.* 54 (Pt A) (2018) 254–258.
- [259] E.P.M. de Almeida, J.P. de Almeida, G. Landoni, F. Galas, J.T. Fukushima, E. Fominskiy, et al., Early mobilization programme improves functional capacity after major abdominal cancer surgery: a randomized controlled trial, *Br. J. Anaesth.* 119 (5) (2017) 900–907.
- [260] C.W. Wagoner, C. Singh, A. Thomas, J.C. Dort, G. Nelson, K.M. Sauro, Early mobilization compliance and post-operative outcomes across surgical types: a retrospective cohort study analysis, in prep 2025.
- [261] R. Fu, A. Thomas, G. Nelson, M. Brindle, K. Sauro, Identification of enhanced recovery after surgery (ERAS) essentials to improve postoperative outcomes: A multicenter study, *Clin. Nutr. ESPEN* 72 (April 2026) 103202.
- [262] T.J. Daskivich, J. Houman, M. Lopez, M. Luu, P. Fleshner, K. Zaghiyan, et al., Association of wearable activity monitors with assessment of daily ambulation and length of stay among patients undergoing major surgery, *JAMA Netw. Open* 2 (2) (2019), e187673.
- [263] C.A. Low, D.H. Bovbjerg, S. Ahrendt, M.H. Choudry, M. Holtzman, H.L. Jones, et al., Fitbit step counts during inpatient recovery from cancer surgery as a predictor of readmission, *Ann. Behav. Med.* 52 (1) (2018) 88–92.
- [264] S. Wolk, S. Linke, A. Bogner, D. Sturm, T. Meißner, B. Müsle, et al., Use of activity tracking in major visceral surgery-the enhanced perioperative mobilization trial: a randomized controlled trial, *J. Gastrointest. Surg.* 23 (6) (2019) 1218–1226.
- [265] D.A. Hashimoto, G. Rosman, D. Rus, O.R. Meireles, Artificial intelligence in surgery: promises and perils, *Ann. Surg.* 268 (1) (2018) 70–76.
- [266] E. Kang, B.M. Gillespie, G. Tobiano, W. Chaboyer, Discharge education delivered to general surgical patients in their management of recovery post discharge: a systematic mixed studies review, *Int. J. Nurs. Stud.* 87 (2018) 1–13, <https://doi.org/10.1016/j.ijnurstu.2018.07.004>.
- [267] A.M. Almeida, L. Lima, T. Martins, Monitoring patient-reported outcomes in self-management of postsurgical symptoms in oncology: a scoping review, *Cancer Nurs.* 48 (1) (2025) 31–44, <https://doi.org/10.1097/NCC.0000000000001250>.
- [268] E. Bertocchi, G. Barugola, G. Masini, M. Guerriero, N. Menestrina, I. Gentile, et al., iColon, a patient-focused mobile application for perioperative care in colorectal surgery: Results from 444 patients, *J. Telemed. Telecare* 31 (4) (2025) 585–591, <https://doi.org/10.1177/1357633X231203064>.
- [269] S.L. van der Storm, M. Jansen, M.D. Mulder, H.A. Marsman, E.C.J. Consten, F.C. den Boer, et al., ERAS APptimize collaborative study group. Improving enhanced recovery after surgery (ERAS): the effect of a patient-centred mobile application and an activity tracker on patient engagement in colorectal surgery, *Surg. Innov.* 32 (1) (2025) 5–15, <https://doi.org/10.1177/15533506241299888>.
- [270] O. Zivanovic, L.Y. Chen, A. Vickers, A. Straubhar, R. Baser, M. Veith, et al., Electronic patient-reported symptom monitoring in patients recovering from ambulatory minimally invasive gynecologic surgery: A prospective pilot study, *Gynecol. Oncol.* 159 (1) (2020) 187–194, <https://doi.org/10.1016/j.ygyno.2020.07.004>.
- [271] O. Ljungqvist, H.D. de Boer, A. Balfour, W.J. Fawcett, D.N. Lobo, G. Nelson, et al., Opportunities and challenges for the next phase of enhanced recovery after surgery: a review, *JAMA Surg.* 156 (8) (2021) 775–784.
- [272] L. Wijk, R. Udumyan, B. Pache, A.D. Altman, L.L. Williams, K.M. Elias, et al., International validation of enhanced recovery after surgery society guidelines on enhanced recovery for gynecologic surgery, *Am. J. Obstet. Gynecol.* 221 (3) (2019) 237.e1–237.e11.
- [273] J. Hayek, A. Zorrilla-Vaca, L.A. Meyer, G. Mena, J. Lasala, M.D. Iniesta, et al., Patient outcomes and adherence to an enhanced recovery pathway for open gynecologic surgery: a 6-year single-center experience, *Int. J. Gynecol. Cancer* 32 (11) (2022) 1443–1449, <https://doi.org/10.1136/ijgc-2022-003840>.
- [274] U.O. Gustafsson, J. Hausel, A. Thorell, O. Ljungqvist, M. Soop, J. Nygren, Adherence to the enhanced recovery after surgery protocol and outcomes after colorectal cancer surgery, *Arch. Surg.* 146 (5) (2011) 571–577.
- [275] J.R. Berian, K.A. Ban, J.B. Liu, C.Y. Ko, L.S. Feldman, J.K. Thacker, Adherence to enhanced recovery protocols in NSQIP and association with colectomy outcomes, *Ann. Surg.* 269 (3) (2019) 486–493.
- [276] K.A. Black, A. Thomas, K.M. Sauro, G. Nelson, Effect of enhanced recovery after surgery compliance on postoperative venous thromboembolism, *BJS Open* 9 (2) (2025), zraf018, <https://doi.org/10.1093/bjsopen/zraf018>.
- [277] G. Nelson, A. Thomas, S.P. Bisch, H.D. de Boer, B.B. Pultrum, H. Smid-Nanninga, et al., Enhanced recovery after surgery compliance and outcomes in an international multisurgical cohort, *BJS Open* 10 (1) (2025), zraf152, <https://doi.org/10.1093/bjsopen/zraf152>.
- [278] M. de Vos, W. Graafmans, M. Kooistra, B. Meijboom, P. Van Der Voort, G. Westert, Using quality indicators to improve hospital care: a review of the literature, *International J. Qual. Health Care* 21 (2) (2009) 119–129.
- [279] N. Ivers, S. Yogasingam, M. Lacroix, K.A. Brown, J. Antony, C. Soobiah, et al., Audit and feedback: effects on professional practice, *Cochrane Database Syst. Rev.* 3 (3) (2025), Cd000259.
- [280] K. Thavorn, S. Kumar, C. Reis, J. Lam, G. Dobell, C. Mulhall, et al., Audit feedback interventions to address high-risk prescriptions in long-term care homes: a costing study and return on investment analysis, *Implementation Sci. Commun.* 2 (1) (2021) 125.
- [281] B. Conombo, J.R. Guertin, J.S. Hoch, J. Grimshaw, M. Bérubé, C. Malo, et al., Implementation of an audit and feedback module targeting low-value clinical practices in a provincial trauma quality assurance program: a cost-effectiveness study, *BMC Health Serv. Res.* 24 (1) (2024) 479.
- [282] K. Sauro, W.A. Ghali, H.T. Stelfox, Measuring safety of healthcare: an exercise in futility? *BMJ Qual. Saf.* 29 (4) (2020) 341–344.
- [283] S. Golder, D. Xu, K. O'Connor, Y. Wang, M. Batra, G.G. Hernandez, Leveraging natural language processing and machine learning methods for adverse drug event detection in electronic health/medical records: a scoping review, *Drug Saf.* 48 (4) (2025) 321–337.