

REVIEW

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Enhanced recovery after surgery: overarching themes of the ERAS[®] Society Guidelines & Consensus Statements for Adult Specialty Surgery

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Abstract

Background The Enhanced Recovery After Surgery (ERAS[®]) Society has overseen the development and publication of more than two dozen specialty-specific guidelines and consensus statements. We conducted an appraisal of existing guidelines to compare and contrast recommendations to identify overarching themes regarding the current role and future direction of those guidelines for clinicians and researchers.

Methods After deriving a list of potential perioperative interventions associated with an ERAS program, specialty-specific guidelines were evaluated on the basis of their inclusion and the strength of the grade of those elements.

Results Following appraisal of the existing ERAS guidelines, a list of common interventions emerges, which includes pre-, intra-, and postoperative care elements that are endorsed by the overwhelming majority of surgical specialties. However, this perioperative rubric should be modifiable to include a broader range of potential perioperative elements, where appropriate, based on literature specific to those subspecialty surgeries.

Conclusions More uniform consensus regarding common care elements is likely to contribute to greater harmony in guidelines development as well as the development of process measures and outcome definitions. Guidelines can thus foster the creation of data repositories, establish program benchmarks, and contribute to future research and knowledge transfer.

Keywords Enhanced recovery programs, Guidelines, Perioperative care

Background

The Enhanced Recovery After Surgery (ERAS[®]) Society has sponsored the expert development and peer-reviewed publication of more than two dozen

multidisciplinary guidelines and expert consensus statements in an effort to consolidate available literature and promote perioperative care best practices for healthcare systems worldwide (Ljungqvist et al. 2021). In 2020, the ERAS[®] Society guideline steering group standardized the development process for all surgical specialties to establish or update guidelines, emphasizing a formal structure for the recruitment of a multidisciplinary expert panel, rigorous medical literature search and review, consolidation and grading of the evidence, and construction of phase-specific recommendation statements (Brindle et al.

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2020). All final manuscripts were ultimately endorsed by ERAS® Society leadership.

Guidelines and expert consensus documents are developed on the basis of surgical specialty, which may encourage the reader to interpret recommendations in a reductionist fashion, rejecting many potentially valuable interventions and considering the application of care elements only if they have met the burden of proof in that individual patient subtype. Examples may include the rational application of preoperative risk-assessment, lung protective ventilation, postoperative nausea prevention, or thromboprophylaxis, which among other potential interventions likely do not require procedure-specific evidence to warrant their adoption. Conversely, when specific care elements are not included in a specialty guideline, readers may seek to apply those interventions without considering appropriateness or overlooking relevant barriers to their adoption. Among these considerations include mechanical bowel prophylaxis, use of certain potentially problematic analgesics/regional techniques, or specific feeding protocols that may lend themselves better to one subspecialty surgery over another one.

Given these common pitfalls, we sought to compare and contrast the available ERAS® Society guidelines and consensus statements to identify global themes that should be considered for all surgery subspecialties as well as to highlight important distinctions between existing specialty recommendations. In addition, we sought to determine if there is evidence for an added role for the guideline statements (beyond providing a framework for clinical care) supporting quality of care benchmarking and future research.

Main text

All existing ERAS® Society guidelines and consensus statements were reviewed. A list of potential perioperative care elements was developed, derived from prior standards and expert opinion. Recommendations and their associated literature were identified and tabulated with annotations according to the Grading of Recommendations, Assessment, Development and Evaluation (GRADE) system as follows: (Verhagen et al. 1998).

Strength of recommendation color scheme:

Green = Strong recommendation (i.e., class I or IIa).

The desirable effects of adherence to a recommendation outweigh the undesirable effects.

Yellow = Weak recommendation (i.e., class IIb). The desirable effects of adherence to a recommendation probably outweigh the undesirable effects, but with less confidence.

White = Guideline or consensus statement either omitted the care element or provided a recommendation suggesting equivalence or harm (i.e., class III).

The results are summarized in Table 1, identifying common themes and countervailing distinctions among the surgical subspecialties as captured within existing guidelines and consensus statements.

Based on the results of collating potential program care elements across specialties, there are several overarching themes that have emerged, which highlight the importance of guideline and consensus statement development and publication (Table 2). These include the ability to establish a common perioperative pathway, highlighting of specialty care distinction, acknowledgement of the challenges associated with guideline derivation and translation of individual guidelines into tools to support data consortia and promote research.

Common pathway elements

Despite the fact that individual specialty guidelines and consensus statements were derived from unique bodies of literature, a comparison of their recommendations has demonstrated a confluence of certain themes and care elements. What emerges is a common set of care elements shown to be highly efficacious with little or no risk across an overwhelming majority of the surgical subspecialties. They include elements traditionally isolated to either the pre-, intra-, or postoperative stages, as well as those that span the entire perioperative encounter (Table 3). When considering these care elements within any particular specialty, they typically adhere to one of the following characteristics: (a) high grade evidence supporting their efficacy in that given specialty; (b) in the absence of specialty-specific literature, evidence is readily (and appropriately) transferrable from another specialty; and/or (c) their adoption is simple, logical, safe and not resource intensive. Importantly, there is a tendency for guidelines to endorse care elements based on the evidence that emanated from colorectal surgery, despite a relative lack of similar research in their own surgical population. Much of this is potentially appropriate, though not universally, which underpins the value of specifically appraising the literature on a specialty basis. Ultimately, any rational approach to the development of an ERAS program, regardless of the specialty, should include an assessment of the specialty literature relevant to these common care elements.

Subspecialty distinction

Despite the importance of identifying areas of harmony, guidelines are also a vehicle to provide distinction between specialties. As outlined in Table 4, there are

Table 1 Summary of phase-specific ERAS® specialty recommended elements Colorectal (Gustafsson et al. 2019), Cardiac 2019 (Engelman et al. 2019), Vascular 2022 (McGinagle et al. 2022), Bariatric 2022 (Stenberg et al. 2022), Breast 2017 (Temple-Oberle et al. 2017), Cytoreductive 2020 (Hübner et al. 2020a; Hübner et al. 2020b), Cesarean Delivery 2018 (Wilson et al. 2018; Caughey et al. 2018; Macones et al. 2019), Radical Cystectomy 2013 (Cerantola et al. 2013), Emerg Lap 2023 (Peden et al. 2021; Scott et al. 2023; Peden et al. 2023), Esophagectomy 2019 (Low et al. 2019), Gyn/Oncology 2019 (Nelson et al. 2019), Head and Neck 2017 (Dort et al. 2017), Hip and Knee 2020 (Wainwright et al. 2020), Liver 2023 (Joliat et al. 2023), Lung 2019 (Batchelor et al. 2019), Pancreatoduodenect 2019 (Melloul et al. 2020), Rectal/Pelvic 2012 (Nygren et al. 2012), Lumbar Spinal 2021 (Debono et al. 2021), LMIC Abd/Pelvic 2022 (Oodit R et al. 2022)

	Colorectal 2019	Cardiac 2019	Vascular 2022	Bariatric 2022	Breast 2017	Cytoreductive 2020	Cesarean Delivery 2018	Radical Cystectomy 2013	Emerg Lap 2023	Esophagectomy 2019	Gyn/Oncology 2019	Head and Neck 2017	Hip and Knee 2020	Liver 2023	Lung 2019	Pancreatoduodenect 2019	Rectal/Pelvic 2012	Lumbar Spinal 2021	LMIC Abd/Pelvic 2022
Preoperative																			
Patient education and counseling																			
Alcohol abuse and smoking cessation																			
Multifaceted risk assessment																			
Prehabilitation																			
Nutritional screening & treatment																			
Anemia screening & treatment																			
PONV screening & prophylaxis																			
Pre-anesthetic multimodal analgesia																			
Infection/sepsis prevention bundle																			
Avoid mechanical bowel preparation																			
Clear liquids until 2 hours prior to surgery																			
Oral carbohydrates in non-diabetics																			
Intraoperative																			
Short acting anesthetics																			
Cerebral function/neuromonitoring																			
Reverse neuromuscular blockade																			
Goal directed fluid therapy																			
Minimally invasive approaches																			
Lung protective ventilation																			
Regional analgesia																			
	Colorectal 2019	Cardiac 2019	Vascular 2022	Bariatric 2022	Breast 2017	Cytoreductive 2020	Cesarean Delivery 2018	Radical Cystectomy 2013	Emerg Lap 2023	Esophagectomy 2019	Gyn/Oncology 2019	Head and Neck 2017	Hip and Knee 2020	Liver 2023	Lung 2019	Pancreatoduodenect 2019	Rectal/Pelvic 2012	Lumbar Spinal 2021	LMIC Abd/Pelvic 2022
Postoperative																			
Early extubation																			
Avoid perioperative hypothermia																			
Opioid sparing multimodal analgesics																			
Thromboprophylaxis																			
Maintain euolemia																			
Early removal of urinary catheter																			
Avoid hyperglycemia																			
Early resumption of a normal diet																			
Early mobilization																			
Audit and feedback																			
Utilize delirium screening																			
Utilize patient engagement tools																			
Early physiotherapy																			

Green = strong recommendation, Yellow = weak recommendation, White = No specific recommendation, GI = gastrointestinal, LMIC = low-middle-income countries

Table 1 (continued)

Green, strong recommendation; *Yellow*, weak recommendation; *White*, no specific recommendation; *LMIC*, low-middle-income countries; *PONV*, postoperative nausea and vomiting; *GI*, gastrointestinal

Table 2 Overarching themes

Core themes	
Benefits	Limitations
- Establish a common perioperative pathway with elements that meet the following criteria: (a) High-grade evidence in that specialty, or (b) Lack evidence specific to that specialty, but existing evidence is appropriately transferable, or (c) Inclusion is simple, logical, safe, and not resource-intensive - Provides a baseline rubric for elements that should be considered for additional specialty guidelines - Opportunity to readily identify and highlight clear distinctions between specialties	- Common perioperative pathway is rooted largely in the original colorectal guidelines, which may limit the scope - Potential for inappropriate adoption of surrogate evidence across specialties - Requires sensitivity to resource and infrastructure limitations that may exist within certain practice locations
- Element definitions can provide a basis for data registries, multi-center study, and quality benchmarking among participating centers - Guideline iteration incorporates updated literature to facilitate program implementation and maturation	- Current guidelines could be expanded to a greater extent to include relevant specialty-specific guidance (i.e., cardiac surgery) - It is necessary to define the scope of an ERAS® program (i.e., how many elements across what timeframe are necessarily included) - Process measures and clinical outcomes require valid, clear, and quantifiable definitions to allow for accurate data derivation and consistency across institutions - Broad program/institutional representation is required to reflect relevant practice/impact - Guideline iteration is lengthy and time-consuming, thus challenging to maintain and update

Table 3 Common perioperative pathway care elements

Overall
Patient education
Avoidance/minimization of <i>nil per os</i> (NPO) status
Surgical site infection/sepsis prevention bundle
Multimodal, opioid-sparing analgesia
Maintenance of euolemia
Avoidance of unplanned hypothermia
Auditing and feedback
Preoperative
Alcohol and smoking cessation
Prehabilitation
Nutritional screening and treatment
Intraoperative
Short-acting anesthetics
Minimally invasive surgical techniques
Regional analgesia
Postoperative nausea and vomiting (PONV) screening and prophylaxis
Postoperative
Avoidance/early removal of drains and tubes
Early mobilization
Mechanical or chemical thromboprophylaxis

a number of care elements unique to a given specialty, whether due to explicit indication for or contraindication to their administration. Examples include antifibrinolytic

use in cardiac or certain orthopedic surgeries, where the risk of excessive bleeding is notably higher, or oral anti-histamine use in cesarean section, where aspiration is more prevalent. One strength of the current ERAS guidelines standard is that those differences are readily highlighted and reinforced with specialty-specific evidence and expert consensus. However, the current offerings could be expanded to a greater extent. It is possible that adherence to the traditional ERAS guidelines framework is commonly done at the expense of addressing important specialty-specific perioperative care elements. For example, notably absent from the cardiac surgical guidelines are opportunities to appraise the literature for additional care elements including cardiopulmonary bypass strategies, comprehensive patient blood management, postoperative atrial fibrillation prevention, and intraoperative neuromonitoring. In this fashion, it may well be that the ERAS rubric, which was founded on pre-, intra-, and postoperative elements originally in colorectal surgery, requires significant expansion to better articulate the relative scope of specialty-specific perioperative care.

Tool to inform practice

The intent of guidelines and consensus statements is to provide an appraisal of the evidence and recommendations for best perioperative practice within a given surgical field. They should not, however, be rigidly viewed as a standard of care. Rather, practitioners are encouraged to

Table 4 Specialty-specific ERAS® recommendations**Colorectal** (Gustafsson, et al., 2019)

Pelvic and peritoneal drains should not be used routinely
 Postoperative nasogastric tubes should not be used routinely
 Thoracic epidural analgesia is recommended in open colorectal surgery
 Spinal anesthesia is recommended as an adjunct option to general anesthesia in laparoscopic surgery
 Routine transurethral catheterization is recommended for 1–3 days

Cardiac (Engelman et al. 2019)

Tranexamic acid or epsilon aminocaproic acid during on-pump cardiac surgical procedures
 Maintenance of chest tube patency to prevent retained blood
 Rigid sternal fixation to improve or accelerate sternal healing and reduce mediastinal wound complications
 Interventions to detect and avoid acute kidney injury

Vascular (McGinagle et al. 2022)

Continue aspirin throughout the perioperative period
 Invasive cardiovascular monitoring with an arterial monitoring catheter is essential; the MAP should be maintained to near baseline values and at or > 65 mmHg
 Use cell salvage

Bariatric (Stenberg et al. 2022)

Preoperative weight loss using a very low or low-calorie diet prior to bariatric surgery
 Patients with diabetes and treatment with glucose-lowering drugs should closely monitor treatment effects and be aware of the risk for hypoglycemia
 Initially, all operations should be supervised by a senior surgeon with significant experience in bariatric surgery
 A regimen of life-long vitamin and mineral supplementation/ nutritional biochemical monitoring is necessary
 Ursodeoxycholic acid for 6 months after bariatric surgery for patients without gallstones at the time of surgery

Breast (Temple-Oberle et al. 2017)

Flap monitoring within the first 72 h should occur frequently

Cesarean delivery (Wilson et al. 2018; Caughey et al. 2018; Macones et al. 2019)

Antacids and histamine H2 receptor antagonists as premedication to reduce the risk of aspiration pneumonia
 Optimal gestational weight gain management should be used to control their weight during pregnancy
 Maternal hypertension should be managed during pregnancy

Emergency laparotomy (Peden et al. 2021)

Screen, monitor, and source control for sepsis and accompanying physiological derangement
 Palliative care and end-of-life management
 Fascial wound protector, irrigation, and glove change in abdominal closure

Hip and knee (Wainwright et al. 2020)

Tranexamic acid is recommended to reduce perioperative blood loss
 The routine application of chest tube external suction should be avoided
 Team-based functional discharge criteria should be used to facilitate patient discharge directly to their home

Lung (Batchelor et al. 2019)

Chest tubes should be removed even if the daily serous effusion is of high volume (up to 450 ml/24 h)

Rectal/pelvic (Nygren et al. 2012)

A multimodal approach to optimizing gut function after rectal resection should involve chewing gum

utilize clinical judgment supplemented by patient preference and shared decision making. In addition, as scarce resources may impact utilization, guidance should be considered within the context of the “ideal clinical scenario.” Further, the ability to guide care is subject to the available data, which requires regular reassessment and revision as new knowledge emerges. The best example of this is provided in the 2019 iteration of the gynecologic/oncology surgical guidelines, which specifically

delineated which care elements and associated recommendations were altered based on the results of their updated literature review and expert consensus. Moreover, this group also recently published an abbreviated version of their guideline in which specific implementation challenges were addressed by clinician stakeholders (Nelson et al. 2023). Additional examples are anticipated as other specialty updates are published.

In addition to assisting programs regarding best practice, each guideline establishes a specific, objective, and quantifiable definition for a given care element. Those definitions provide the necessary foundation for local program data collection (i.e., both process measure and outcome), data auditing and clinical feedback, and finally data registry creation and institutional benchmarking (Elias et al. 2019). To date, there have been numerous examples of this process, which have also served as the basis for validation of their respective guidelines. Utilizing data from an international registry based on the original colorectal ERAS guidelines, researchers found that greater compliance was independently associated with shorter hospital stay and reduced postoperative complications (The Impact of Enhanced Recovery Protocol Compliance on Elective Colorectal Cancer Resection: Results From an International Registry 2015). This has been followed more recently by an international validation study, which found that for each unit of improved compliance with the ERAS guidelines for gynecologic/oncology surgery, patients experienced shorter length of stay and lower risk of complications (Wijk et al. 2019). Conversely, another study showed that poor compliance with an ERAS guideline-derived protocol was an independent risk factor for poor survival following laparoscopic colorectal surgery (Pisarska et al. 2019). In this fashion, multicenter registries provide the foundation for advanced analytics and pragmatic trial design, which both better inform perioperative practice and further tailoring of subsequent guidelines in those subspecialty areas.

Ultimately, protocolization, where appropriate, serves to minimize unwanted variability in care, both at the provider and institutional level. Similarly, guideline-derived protocols allow for desired or necessary variations in care in an effort to facilitate research, inform quality improvement efforts, and promote knowledge transfer.

Limitations and future direction

The observations made through this work are based on the assessment of the literature by experienced ERAS guideline authors. When a specific care element was not included in the final version of the text, this may have been the result of poor or conflicting evidence for its inclusion or, more problematically, because the care element was not identified during the initial stages of consideration. In addition, variability between guideline elements was apparent when examining those that were either highly phase-of-care specific or centered on a unique patient cohort. These critical areas of guideline variation may reasonably represent an important gap in our current understanding and form the basis for additional appraisal.

Conclusions

This review serves as a reference for the inclusion of a common set of care elements for future perioperative surgical specialty guidelines and consensus statements. Surgical specialties can thus better highlight commonalities as well as reinforce critical differences in the perioperative care of their unique patient populations. The recently published Perioperative Care in Cardiac Surgery: Joint Consensus Statement by the ERAS® Cardiac Society, ERAS® International Society, and the Society of Thoracic Surgeons provides a useful example of this approach, specifically addressing each of the common elements along with a host of specialty-specific aspects of care as well (Grant et al. 2024). Benchmarks established through this and future work may then serve as the basis for ongoing discovery and highlight elements of surgical best practice.

Abbreviation

ERAS Enhanced Recovery After Surgery

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MG – Data collection, table/figure development, manuscript drafting and revision
DE – Conception, data collection, table/figure development, manuscript drafting and revision

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Data availability

No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Competing interests

MCG and DTE serve as non-remunerated members of the Executive Board of the ERAS® Cardiac Society. DTE discloses that he is on the Device Safety Monitoring Board for Edwards Lifesciences, The Trial Steering Committee for Alexion, Renibus Therapeutics, Cardiorenal Systems, and Genentech, and the Advisory Boards of Medela and Arthrex.

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