



Enhanced recovery after surgery implementation: A clinical review

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Abstract

Enhanced recovery after surgery (ERAS) is a multimodal approach to perioperative care, aiming to improve outcomes and increase the potential for patient recovery. Therefore, the ERAS process care includes mainly preoperative optimization of patient conditions, early oral intake, pain control, fluid management, and early mobility. As a multimodal and multidisciplinary strategy, ERAS program implementation involves surgeons, anesthesiologists, an ERAS coordinator, and the care unit personnel. Initiated in cardiac surgery, the ERAS protocols have been increasingly developed in colorectal surgery leading to the publication of consensus and guidelines by the ERAS Society. Currently, the ERAS program implementation has been generalized to almost all surgical subspecialties leading to the elaboration of various evidence-based consensus and guidelines. The goal of the ERAS programs is to promote fast postoperative recovery as quantified by reducing hospital stay length, decreasing complications, and specific surgical care cost. This review provides an overview on the ERAS protocol implementation across various surgical disciplines with a focus on quantified metric improvement, current ERAS practices and clinical success rates.

Keywords: ERAS protocols, surgical care process, guidelines, outcomes, clinical success

Introduction

ERAS care process principles

Enhanced recovery after surgery (ERAS) has been initiated cardiac surgery, then developed in colorectal surgery and currently generalized to the most surgical subspecialties including esophageal, orthopedic, gynecologic, thoracic, hepatic, pancreatic, urologic, neurosurgical, bariatric, plastic, and breast surgery. Formed in 2001, the ERAS study group has led to the creation of the ERAS Society (erassociety.org). This ERAS society has performed randomized controlled trials, meta-analyses, and large prospective cohort studies leading to the elaboration of evidence based consensus, guidelines and protocols for the clinical practice [1]. Independently of the surgical procedures and specialties, the ERAS protocols are based on preoperative optimization of patients, perioperative stress reduction, maintenance of postoperative physiologic function, and reduced recovery time following surgery [2].

The implementation of the ERAS protocols is accomplished by a multidisciplinary team incorporating outpatient clinical staff, nurses, anesthesiologists, postoperative recovery staff, dietitians, physiotherapists, social workers, and surgeons [2]. The multidisciplinary team efforts are engaged to implement the ERAS recommendations and guidelines with various evidence levels (high, moderate, low, very low) in the multi-setting phases of care including preoperative, intraoperative, and postoperative periods (Table1) [1, 2].

Preoperative phase

The preoperative setting includes the pre, intra and post-admission periods. The ERAS elements of care focused on the optimization of patient conditions including nutritional evaluation and supplementation if needed, comorbidity management, alcohol consumption reduction, smoking cessation, and surgical information/counseling [3]. In colorectal surgery, considered stoma education is considered

as part of the ERAS protocols, and studies showed a shorter total hospital length stay as patients were able to anticipate their post-surgery care and subsequent daily life changes [4]. Beyond basic nutrition, oral immunonutrition during 7 days prior to surgery time has been reported by many ERAS guidelines with evidence levels varying from low to moderate [1, 2]. Fasting leads to a catabolic metabolic state resulting in decreased liver glycogen stores, increased insulin resistance and post-operative stress [5]. Consequently, oral intake of clear liquids (including immunonutrition) 2 hours or more before surgery is strongly recommended and does not increase the risk of aspiration [1, 2]. Well documented, postoperative hyperglycemia results in increased morbidity and mortality, thus, controlling glycemia is a critical component of post-operative care. Moreover, the administration of a carbohydrate-rich drink in patients with type 2 diabetes induces insulin release before surgery, promoting an anabolic metabolic state [6]. In addition, preoperative carbohydrate-rich drink administration decreases overall gastrointestinal discomfort with reducing postoperative nausea and antiemetic use [7]. Thromboembolic, antimicrobial and nausea prophylaxis, and bowel preparations are also recommended before the time of surgery [3].

Intraoperative phase

The intraoperative ERAS elements include encouraging minimally invasive techniques to minimize the stress of surgery, avoiding hypothermia, strictly controlling glycemia, maintaining normal fluid volemia, reducing surgical drain use, and avoiding nasogastric tube usage [1, 2]. Intraoperative fluid management should be optimized to avoid complications related to hypovolemia and fluid overload [8]. Indeed, ERAS protocols should standardize resuscitation approaches to avoid volemia variations. The ERAS protocols highly recommended the use of neuraxial

anesthesia and anatomical anesthetic in a bite to reduce narcotic use. In addition, a significant decrease in narcotic use has been reported by a meta-analysis of randomized controlled trials with the use of peripheral nerve blocks (PNB) [9]. Patients who received PNBs, reported less pain 72 hours following surgery promoting a shorter stay length and increased physical therapy [9]. The combined use of PNB with narcotics in orthopedic procedures was associated with lower pain scores. Also, the use of blocks prior to surgical incision resulted in reducing postoperative pain with long-lasting effects and decreasing subsequent development of chronic pain [10].

Postoperative phase

Early return to function, immediate mobilization, early oral feeding are highly recommended in the postoperative period, and these are accomplished by multimodal control of pain with minimization of narcotic use leading to decreased postoperative nausea/vomiting and ileus [1, 2]. Instead of nil per os (NPO) strategy or delayed direct oral nutrition in fear of the increased risk of complications including nausea/vomiting, aspiration, and anastomotic breakdown, the increased evidence currently supports that early oral feeding with 42 hours is associated with reduced mortality and no increase in anastomotic leak [11, 12]. In addition, postoperative protein intake is important to achieve anabolic metabolism and reduce post-surgical recovery time. High protein diet (> 60% of daily protein requirements) in postoperative days 0-3 was associated with reduced hospital stay length in elective surgery [13]. Overall, the successful implementation of the ERAS protocols depends on the multidisciplinary team with the importance of collaboration, communication, and staff education to ease program implementation [14]. Also, patient and family education is so important for successful implementation.

Clinical outcomes and research

The ERAS protocols assessment is based on clinical outcomes and analysis of the improvement metrics. Based on a continuous audit of the care process using the ERAS Interactive Audit System, the ERAS society provides a strong recommendation grade with various evidence-based protocols. Also, collecting and comparing the center-specific data to other ERAS centers allows refinement of the protocols and improvement of outcomes. The quantitative measurement of clinical success and improvement includes data collection for a multitude of postoperative outcomes such as shown in table 2 for elective colorectal surgery. Analysis of patient factors including sex, age, American Society of Anesthesiologist (ASA) classification, body mass index (BMI), comorbidities) and operative components (neoadjuvant treatment, procedure type, and surgical approach) can be performed using univariate and multivariate analysis regression [15].

The ERAS society provides an online database, and the ERAS Interactive Audit System is used to collect a large multicenter data across multiple surgical specialties [15].

In colorectal surgery, a large cohort review including 2,352 colorectal surgical procedures from 13 different medical centers across 6 countries, during the period ranging from 2008 to 2013, showed that increased ERAS protocol compliance led to reduced hospital stay length and lower complications (Table 2) [15]. The clinical outcomes can be increasingly improved when compliance with ERAS

components, was 70% to 80% or more [16, 17]. Indeed, compliance to ERAS protocols greater than 90% was associated with a 25% shorter stay length, compared to less than 50% ERAS compliance. In addition, decreased stay length and overall decreased complications was observed in laparoscopic surgery with ERAS protocol implementation [15]. Validating previous results, a multitude of reviews including a Cochrane Review analyzing 4 randomized controlled trials (RCTs) revealed a decreased overall complications and shorter hospital stay lengths with a high ERAS protocol compliance [18].

Recently published (2016), a subsequent Cochrane Review focusing on major upper gastrointestinal, liver, and pancreatic surgery, including 10 RCTs with 1000 patients (499 randomly assigned to ERAS protocol and 515 previous standards of care) replicated the previously reported results which were the decreased hospital stay length and reduced overall complications with increased ERAS compliance [19]. Furthermore, the mean hospital stay length was shorter in the ERAS protocols compared to standard treatment for total hip or knee joint replacements in orthopaedic surgery. Additionally, high ERAS compliance was associated with reduced overall healthcare costs.

Despite the additional cost of drugs, a significant reduction in health care costs has been reported with the ERAS protocols, including ambulatory surgery, hospital care per day, and physical therapy session costs [20].

Instead of early recovery and decreased hospital stay lengths, decreasing intraoperative and postoperative narcotic use is a goal of ERAS protocols. The multimodal narcotic-sparing control of pain is the central tenet of all ERAS guidelines, with encouraging the use of non-steroidal anti-inflammatory agents, paracetamol, gabapentinoids, regional/neuraxial anesthetics, and intravenous ketamine or lidocaine infusions [21]. This multimodal postoperative pain control aims to allow early mobilization, avoiding postoperative nausea /vomiting and ileus as side-effects of narcotic use. In breast surgery with immediate subpectoral implant-based reconstruction, the use of a multi-modal, opioid-sparing ERAS protocol resulted in a significant reduction of the narcotic amount use in postoperative days 0-2 [22]. This mastectomy specific ERAS protocol was heavily based on preoperative administration of gabapentin combined with the postoperative use of ibuprofen, acetaminophen, and ondansetron. In addition, a Mayo Clinic trial (2015) showed significantly less narcotic use in postoperative days 0- 3 after mastectomy with reconstruction using an abdominal free-flap [23].

Interestingly, similar pain scores have been reported with ERAS and traditional care after surgery, there was a 71% decrease in the amount of oral morphine equivalent used in the ERAS cohort. Additionally, this result is replicated across surgical subspecialties. Implemented in ventral hernia, the ERAS multimodal analgesia protocols have demonstrated a postoperative decreased opioid requirement with the near elimination of the need for pain control analgesia [24]. As showed by a meta-analysis of 27 randomized clinical trials, in-hospital narcotic usage was still used in 50% of cases; however, in most of them, narcotic use was not needed after discharge. However, the published ERAS data do not demonstrate an explicit correlation between ERAS protocol compliance and post-discharge narcotic usage, and this remains a challenge in analyzing the ERAS pain control results [21]. In addition,

opioid exposure, body mass index, and history of chronic pain diagnosis; may bias patient selection ^[23], so, further studies are necessary in this setting.

Initially implemented in colorectal surgery, the ERAS protocol implementation has been extended to different surgical subspecialties with the development of multiple consensus and guidelines. Currently, there are 22 separate consensus, recommendations, and guidelines published by the ERAS society including pancreatic esophageal, thoracic, cardiac, gynecologic, breast, bariatric, head/neck, and urologic surgery. In addition, ERAS research has been recently expanded to include acute care and trauma surgery, especially urgent colonic resection and obstetric emergency (cesarean sections) ^[25].

A successful ERAS protocol implementation depends on implementation capacity and compliance with protocol guidelines. Therefore, more effective coordination within the multidisciplinary team staffs is highly required for the successful application of standardized perioperative care regimen across multiple settings ^[26]. Despite the vast clinical success and very high rate of ERAS compliance, variation in ERAS protocol compliance within the multidisciplinary phases of care has been reported. Increased compliance within the pre and intraoperative phases has been shown, however, significant variation in protocol implementation has been noted in the postoperative setting ^[27]. As an example, ERAS protocols recommend the removal of the nasogastric tube after operation; however, a multinational study involving more than 1,000 colorectal surgical procedures has reported that nasogastric tube was postoperatively left in nearly 50% of cases.

Future perspectives

After successful implementation across a growing number of surgical subspecialties, the ERAS protocols have been expanded into acute care and trauma surgery, especially urgent colonic resection and obstetric emergency (cesarean sections). Beyond generalization to almost all surgical subspecialties, extended long-term follow-up over 10 years, and the increasing number of randomized controlled trials supporting the clinical practices, the ERAS protocols are gaining increased validity and credibility with performing new studies on outcomes including overall mortality beyond the perioperative period. therefore, the oncologic outcomes including cancer recurrence and free survival with time to adjuvant therapies are gaining more research attention. Although the lack of data regarding whether ERAS protocols can lead to decreasing narcotic use and dependence after discharge, more research attention should be concentrated in this setting during the coming years.

Conclusion

The perioperative care optimization is the main goal of the ERAS protocols implementation based on multimodal and multidisciplinary efforts. The widespread acceptance and use across all surgical subspecialties have been increasingly supported by an increased number of clinical outcome data with continuous analysis of guidelines in a bid to quantifying the clinical success. The continued revision of ERAS protocols has increased the protocol compliance and improvement of the recovery parameters after surgery, resulting in further improving clinical outcomes and controlling health care costs.

Conflicting Interest: none declared.

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