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Review Article

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Enhanced Recovery after Surgery in Bariatric Surgery

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ABSTRACT

The enhanced recovery after surgery (ERAS) program is now widely applied in bariatric surgeries and other surgical procedures. The ERAS program in bariatric surgery consists of various components similar to that in colorectal surgery or other procedures. The major concept of the ERAS protocol relies on a multidisciplinary and multimodal approach to resolve various problems after surgical treatment. The key principles of the ERAS program in bariatric surgery include patient education, opioid-sparing multimodal pain management, prophylaxis of postoperative nausea and vomiting, goal-directed fluid therapy, and minimizing insulin resistance and catabolism. Several guidelines and studies, including randomized clinical trials and systematic reviews, have advocated for the ERAS program in bariatric surgery, which has consistently shown advantages in shortening hospital stay without increasing morbidity. The systematic application of the ERAS program in bariatric patients results in less pain and early recovery and should be routinely recommended.

Keywords: Morbid obesity; Bariatric surgery; Postoperative care

INTRODUCTION

Bariatric surgery has proven its long-term efficacy in terms of weight loss effect against morbid obesity in many studies [1-3]. In addition, its metabolic effects on many obesity-related metabolic diseases highlight its usefulness in the current world [4,5]. For these reasons, bariatric surgery is now the treatment of choice for morbidly obese patients with or without metabolic disease. The number of procedures performed worldwide has increased from 340,000 to more than 696,000 cases between 2003 and 2018, respectively [6]. Among the various procedures available, sleeve gastrectomy is the most frequently performed procedure worldwide. The explosive expansion of the case volume of bariatric surgery is inevitably related to more adverse or extraordinary situations after surgery. Moreover, the candidates for bariatric surgery have several comorbidities, which can be the cause of deviation from the normal postoperative course. Many surgeons have focused on the standardization of postoperative care after bariatric surgery to minimize uncertainties and ensure early and safe recovery [7,8]. The standard clinical pathway and adaptation of the early recovery after bariatric surgery (ERABS) protocol are essential for safe patient care [9].

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The enhanced recovery after surgery (ERAS) protocol, first described by a group of European surgeons, began as a series of perioperative evidence-based interventions starting for colorectal surgeries [10]. ERAS was meant to develop safe and high-quality postoperative care and hasten the process (fast-track surgery). The major concept of the ERAS protocol relies on a multidisciplinary and multimodal approach to resolve the various problems that may occur after surgical treatment [11]. ERAS or fast-track postoperative recovery programs have been adopted for various types of surgeries, from cardiothoracic to various intra-abdominal surgeries [12,13]. In this study, the ERABS components adopted in various bariatric surgery patients and the evidence on their specific management and efficacy will be reviewed.

ERAS COMPONENTS AFTER BARIATRIC SURGERY

Although various studies regarding the application of the ERAS program in bariatric surgery have already been applied, the actual ERAS guidelines for bariatric surgery were only published by the ERAS Society in 2016. In this guideline, a total of 21 items and 36 recommendations for the application of ERAS in bariatric surgery were reported [8]. Due to the lack of evidence regarding the use of the ERABS program in bariatric surgery, many vital components were endorsed from the data of colorectal surgery studies.

In 2019, the American Society for Metabolic & Bariatric Surgery (ASMBS) published guidelines for perioperative nutritional, metabolic, and nonsurgical support for bariatric surgery patients. In the new guideline, the ERABS program was one of the key updates in 2019 [9]. The ASMBS guideline categorizes the ERABS protocol into the immediate preoperative, intraoperative, and postoperative periods with 11 specific interventions. However, not all recommendations have high-quality evidence, followed by many institutions and clinical trials [14]. Among the many recommendations, the key components followed by most institutions included preoperative counseling, standardized anesthesia protocol, management for postoperative nausea and vomiting (PONV), pain, and prevention of insulin resistance and catabolism.

1. Preoperative period

In the preoperative period, the ERABS protocol recommends the following: 1) pre-operative information, education, and counseling; 2) prehabilitation and exercise; 3) smoking and alcohol cessation; 4) pre-operative weight loss; 5) glucocorticoids; 6) Less pre-operative fasting; and 7) carbohydrate loading [8].

The important components highlighted in the immediate preoperative period are oral carbohydrate loading, reduced fasting, and multimodal pre-anesthesia medication [9]. In general, preoperative fasting and carbohydrate loading are well known to decrease perioperative insulin resistance and metabolic deterioration. However, due to the controversy regarding the adoption of this protocol in patients with diabetic neuropathy and gastroesophageal reflux disease, special attention is required to prevent aspiration during anesthetic induction. Some studies have shown that carbohydrate loading is not a risk factor for aspiration in patients undergoing Roux-en-Y gastric bypass [15]. Compliance with this protocol is variable because of aspiration and safety issues. More studies are needed to define the optimal indications and determine the real risks and benefits.

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2. Intraoperative period

The main components of the ERAS program during the operation include: 1) perioperative fluid management, 2) prophylactic management for PONV, 3) standardized anesthetic protocol, 4) airway management, 5) ventilator strategies, 6) neuromuscular block, 7) monitoring of anesthetic depth, 8) laparoscopy, 9) nasogastric tube, and 10) abdominal drainage [8].

The standard intra-operative anesthesia pathway, protective ventilation strategies, goal-directed fluid management, postoperative nausea and vomiting prophylaxis, and regional block are also mentioned in the ASMBS guidelines [9]. During the operation, proper anesthetic protocols and minimally invasive surgical procedures are essential for early recovery after bariatric surgery.

A goal-directed fluid management and medication protocols for preventing PONV are the most important components of intraoperative ERABS.

3. Postoperative period

In the postoperative period, the following are recommended: 1) postoperative analgesia, 2) thromboprophylaxis, 3) early postoperative nutrition, 4) postoperative oxygenation, and 5) non-invasive positive pressure ventilation [8]

The standard postoperative multimodal approach focuses on early ambulation and recovery. To achieve this goal, the prevention of PONV and multimodal analgesia are the key solutions for postoperative ERAS care because PONV and pain are the main causes of delayed recovery and diet.

The ERAS program is essentially an evidence-based multidisciplinary care pathway aimed at maintaining physiological function, enhancing mobilization, reducing pain, facilitating early nutrition, and reducing perioperative surgical stress. The final goal of the ERAS program is earlier, safer, and more convenient recovery after surgery, which promotes early return to society. To achieve these goals, there are several key principles in the protocol that require the adoption of various multimodal and multi-timing approaches to be achieved. The key principles of the ERAS protocol are as follows:1) patient education, 2) opioid-sparing multimodal pain management strategies, 3) PONV prophylaxis, 4) goal-directed fluid therapy, and 5) minimizing insulin resistance and catabolism perioperatively.

SPECIFIC KEY PRINCIPLES OF THE ERABS PROGRAM

1. Prevention of PONV

PONV is recognized as a spectrum that includes a combination of nausea, vomiting, and retching in the postoperative period. It increases the immediate hospital costs, pneumonia and pulmonary morbidity, and hospital length of stay; delays diet resumption; and causes unexpected readmissions and malnutrition. The most common reason for readmission following bariatric surgery is PONV [16].

PONV is thought to be multifactorial, involving anesthetic, surgical, and individual risk factors [17]. The current strategies for the prevention and treatment of PONV include proactive risk assessment, avoidance of PONV triggers, prophylactic antiemetics in the preoperative setting, rescue antiemetics postoperatively, and the optimization of anesthetic

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protocols. In general, the common risk factors include female sex, history of motion sickness or PONV, non-smoking status, and postoperative use of opioids [18]. Conditions affecting the GE junction, hiatal hernia, obesity itself, presence of blood and secretions in the stomach, anesthetic technique, various medications, and duration of surgery may also place bariatric surgery patients at a higher risk [17].

Prevention is the most important treatment strategy for PONV. Some preventive methods include the selection of anesthetic medication and opioid avoidance. For the management of PONV, several medications, including serotonin receptor antagonists (ondansetron, granisetron), steroids (dexamethasone), and aprepitant, were recommended [19-21]. Various studies have revealed that multi-agent combination treatment enhances the symptom control of PONV. As such, many institutions have adopted the protocol of injecting 8 mg of dexamethasone before initiating anesthesia combined with other antiemetic medications [14]. In addition, total intravenous anesthesia is known to be more effective for PONV, but additional studies are needed [17].

2. Perioperative fluid management

Perioperative proper fluid management is one of the challenging aspects of management during and after bariatric surgery. Obesity is associated with increased total and lean body weight. However, the total body water content is relatively decreased. An unbalanced fluid status makes fluid management difficult and debatable [22]. The blood volume to weight ratio is usually decreased while the body fat accumulates [23]. For this reason, fluid management during bariatric surgery requires more caution. In the past, fluid management was an issue of liberal or restrictive fluid supplements. However, fluid management in the ERAS program is frequently referred to as goal-directed fluid therapy. One nuisance of "goal-directed fluid therapy" is that it might be ambiguous and confusing. This activity highlights balanced fluid management according to the patient's volume status, as estimated by the stroke volume variation.

3. Post-operative pain management

Obesity itself induces respiratory syndrome, and postoperative atelectasis can also induce postoperative hypoxemia. Proper pain management, which guarantees patient comfort and pulmonary hygiene [24], is mandatory to ensure an early recovery without respiratory complications. The key point of pain management in the ERAS program is reducing intravenous opioid injection. The ERAS guidelines from the ERAS society recommend the systematic use of non-opioid analgesics, such as intravenous acetaminophen (paracetamol) and non-steroidal anti-inflammatory drugs. However, some have cautioned that excessive use of non-steroidal anti-inflammatory drugs has been implicated in the development of anastomotic ulcerations, perforations, and leaks. If needed, a proton pump inhibitor should be administered with analgesics. Patient-controlled analgesia devices can help minimize the overuse of opioids and respiratory depression [25].

Although specific protocols vary according to the institution, pre-emptive nonopioid analgesic medication pre- and intra-operatively as part of multimodal pain management improves postoperative pain control and decreases opioid use [26]. For example, one institution administers preoperative gabapentin and acetaminophen and provides postoperative pain expectation handouts and counseling. In addition, port site analgesic injection is routinely performed, with fentanyl administration being limited to 150 μg. Non-opioid management is the first-line treatment, and scheduled acetaminophen or IV ketorolac is administered during the postoperative period [27].

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ERAS STUDIES IN THE FIELD OF BARIATRIC SURGERY

Various studies have been performed to determine the advantages of the ERABS program. Through the primary and secondary endpoints in clinical trials, we can identify the main advantage of the procedure. The primary/secondary endpoints of recent ERABS-related studies are summarized in **Table 1**. Most studies set the length of hospital stay (LOS) as the primary endpoint. Postoperative complications or readmission rates were frequently selected as one of the target endpoints.

Meunier et al. reported a retrospective propensity score matching study with a total of 464 patients and revealed that the implementation of the ERAS program significantly reduced the length of hospital stay without a significant increase in postoperative complications and readmission [28]. A recent Indian randomized controlled trial (RCT) studied 112 patients who underwent sleeve gastrectomy. They were divided into the ERAS and standard pathway arms and evaluated for the length of stay, pain score, PONV, time for rescue analgesia, and ambulation. Hospital stay was significantly lower in the ERAS group. The same group had advantages in terms of pain and early ambulation [29]. In 2020, a systematic review of five ERAS RCT studies, including a total of 610 procedures, revealed that ERAS significantly reduced the length of stay and PONV, though there were no significant differences in terms of adverse events and readmissions [14]. In 2019, two RCT results for RYGB were published, and those were the first published papers after the RCT study conducted by Lemanu et al. [7] with LOS as the primary endpoint for patients undergoing sleeve gastrectomy. Geubbels et al. [30] reported a significant shortening of functional hospital stay in the ERAS group compared with the conventional group, using functional hospital stay, which is the time from the end of the surgery to meeting all discharge criteria, as the primary endpoint, but there was no difference between the two groups in secondary endpoint analysis including total hospital stay, which is the time from surgery to discharge, and health-related quality of life. Ruiz-Tovar et al. [31] used the postoperative pain score measured by the visual analogue scale (VAS) score as the primary endpoint, and showed a significantly lower score in the ERAS group. In particular, analysis of acute phase reactants (white blood cell counts, fibrinogen, C-reactive protein) as secondary endpoints showed low results in the ERAS group, suggesting that measures included in the ERAS program (short pre- and postoperative fasting period, goal-directed fluid administration, multimodal analgesia, etc.) can reduce the immune stress

Table 1. Primary and Secondary endpoints of clinical studies for enhanced recovery after bariatric surgery

Study ID	Design	Sample size	Type of surgery	Primary/secondary outcomes
Lemanu et al. (2013) [7]	RCT	78	SG	LOS/post-operative complications, readmission rates, costs
Parisi et al. (2020) [14]	SR of RCT	610	SG, RYGB	LOS/major adverse events, readmissions, anastomotic leak, intra-abdominal bleeding, mortality, PONV, postoperative pain (VAS)
Meunier et al. (2019) [28]	Propensity score analysis	464	SG, RYGB, SG to RYGB	LOS/post-operative complications, readmission rates
Prabhakaran et al. (2020) [29]	RCT	112	SG	LOS/postoperative pain (VAS), time of first rescue analgesia, readmission rate, complications, PONV
Geubbels et al. (2019) [30]	RCT	220	RYGB	Functional hospital stay/LOS, 30-day complication and mortality rates, duration of surgery, time spent on the recovery ward and health-related quality of life
Ruiz-Tovar, et al. (2019) [31]	RCT	180	RYGB	Postop pain score (VAS)/morphine need during the first 24 hours postoperatively, PONV, Cx, reintervention, readmission, acute phase reactants (WBC, fibrinogen, CRP levels)
Ahmed, et al. (2018) [32]	MA	6,172	SG, RYGB	LOS/overall morbidity, op time, reintervention, readmission, costs
Małczak et al. (2017) [33]	SR & MA	5,230	SG, RYGB, revision, BPD	LOS/overall morbidity, specific complications, mortality, readmissions, costs
Singh et al. (2017) [34]	SR & MA	865	SG, RYGB, BPD	LOS/overall complication, major & minor complications, leak rates, readmission rates

RCT = randomized clinical trial, MA = meta-analysis, SG = sleeve gastrectomy, VAS = visual analogue scale, PONV = post-operative nausea and vomiting, SR = systemic review, RYGB = Roux-en-Y gastric bypass, LOS = length of stay, WBC = white blood cell, CRP = C-reactive protein, BPD = biliopancreatic diversion.

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response. In addition, systematic review and meta-analysis papers commonly reported shortening of LOS as a primary endpoint, and some studies showed that postoperative morbidity and operative time were reduced [32], while others reported no statistical difference in morbidity and readmission rate [33,34]. Further high-quality randomized trials are needed for a better investigation of the application of ERAS in bariatric surgery in the future. Especially, rather than simply focusing on LOS, studies focusing on relevant outcomes related to the specific field of bariatric surgery, for example, some patient-related outcomes such as PONV, postoperative pain, and fatigue as well as outcomes linked to functional status are needed.

CONCLUSIONS

ERABS is an essential treatment strategy for early and safe recovery after bariatric surgery. Many components are recommended during the pre-, intra-, and postoperative periods. However, not all ERAS components are based on high-quality evidence. More clinical applications and further studies will provide stronger evidence for the ERABS program.

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