The ERAS Protocol

5

Luca Cabrini, Martina Baiardo Redaelli, Stefano Turi, and Luigi Beretta

5.1 The Enhanced Recovery After Surgery (ERAS) Protocols

Surgery is associated with a systemic stress response that can be categorized by duration and severity [1]. In 1995 for the first time a "stress-free" colonic resection based on the laparoscopic technique, epidural analgesia, early oral nutrition and mobilization was proposed [2]. Since 1995 many randomized controlled trials, consensus statements, meta-analyses and reviews have contributed to define safe and effective protocols of Enhanced Recovery After Surgery (ERAS) [3].

As defined by Ljungqvist, the concept of ERAS is based on a multidisciplinary and multimodal approach addressing issues that might delay the recovery and cause complications, changing the management according to a continuous evidence-based analysis and periodical internal audits [4].

In 2014, a meta-analysis of 16 randomized controlled trials (RCTs) performed in patients undergoing colorectal surgery, demonstrated how the application of an ERAS pathway was associated with a better outcome (reduction of respiratory and cardiovascular complications) and length of hospital stay, without affecting the readmission rate [5].

In the following years, ERAS guidelines were developed in different areas of surgery: hepatic and pancreatic, upper gastrointestinal, thoracic, urologic and gynecologic, and orthopedic surgery [4].

All the different ERAS protocols are based on common main surgical and anesthesiological items including strategies for evaluation and stratification of preadmission risk [5], preventing and treating postoperative nausea and vomiting [6], avoiding intraoperative hypothermia [7]. A mini-invasive surgical approach is strongly

L. Cabrini (✉) · M. Baiardo Redaelli · S. Turi · L. Beretta
Department of Anesthesia and Intensive Care, San Raffaele Scientific Institute, Milan, Italy
e-mail: cabrini.luca@hsr.it; baiardoredaelli.martina@hsr.it; turi.stefano@hsr.it; beretta.luigi@hsr.it

D. Foschi, G. Navarra (eds.), *Emergency Surgery in Obese Patients*,
Updates in Surgery, https://doi.org/10.1007/978-3-030-17305-0_5

recommended [8, 9]. An adequate pain control with regional anesthesia or multimodal opioid-sparing analgesia [10], a careful perioperative fluid administration, adopting a goal-directed therapy in high-risk patients [11], are recommended to achieve an early mobilization and a quick restart in oral intake of fluids and solids.

Moreover, in the effort to obtain a rapid return to an adequate level of functional activity after a major procedure, ongoing ERAS researches are evaluating the efficacy of multimodal prehabilitation programs [12].

Nowadays, ERAS principles are applied in more than 20 countries and have been associated with an improvement in the quality of recovery after surgery, through a reduction in complications and in the length of hospital stay, with associated economic benefits [4].

Finally, a growing number of data suggest that high-risk patients, such as elderly and frail patients, should markedly benefit from ERAS programs reducing the impact of their comorbidities and the increased risk of developing postoperative complications [13].

5.2 The ERAS Protocol in Bariatric Surgery

The worldwide increase in the prevalence of obesity has led to a rise in the number of bariatric surgical procedures [14, 15]. Obesity leads to numerous changes in individual pathophysiology and requires specific management in order to provide safe bariatric surgery.

The main peculiarites of obese patients include:

1. Different patient shape: visceral vs. peripheral obesity. Compared to those patients with isolated peripheral fat distribution, patients with central obesity are at highest perioperative risk [16].
2. Alterations of the respiratory system: reduced lung functional residual capacity, more atelectasis and shunting in dependent lung regions, and increased work of breathing and oxygen demand.
3. High incidence of obstructive sleep apnea (10–20% in patients with BMI >35 kg/m^2), which is associated with a more than double rate of postoperative respiratory and cardiac failure [17].
4. Increased cardiovascular risk, including atrial fibrillation, arrhythmias and sudden cardiac death, prolonged QT interval, and highest rates of ischemic heart disease and heart failure [18].
5. Prothrombotic state [19].
6. Increased insulin resistance.
7. Different volumes of drug distribution.

5.2.1 ERAS Guideline Recommendations for Bariatric Surgery

Bariatric patients present unique challenges in the management of perioperative risks [20]. The ERAS protocol aims to reduce the body's stress response, reduce

organ dysfunction, and shorten hospital length of stay, and the key endpoint is the quality of the recovery [4]. To date, the literature supporting the use of ERAS in bariatric surgery is limited but it is rapidly growing. In 2016 the ERAS Society published the guidelines for bariatric surgery [21]: the recommendations are summarized below.

5.2.1.1 Preoperative Recommendations

- Provide patient preoperative counseling.
- Prehabilitation may improve the outcome.
- Patients should stop smoking at least 4 weeks before surgery.
- Alcohol abusers should observe at least 2 years of abstinence. The risk of new onset of alcohol abuse or relapse after gastric bypass should be assessed.
- Patients should lose weight before surgery. The risk of hypoglycemia should be acknowledged for patients receiving glucose-lowering drugs.
- Postoperative nausea and vomiting (PONV) and inflammatory response should be prevented with 8 mg of intravenous dexamethasone before anesthesia induction (preferably 90 min earlier).
- Fasting: 6 h for solids and 2 h for clear fluids is required before anesthesia induction. More data are needed for diabetic patients with autonomic neuropathy to assess the risk of aspiration.

5.2.1.2 Intraoperative Recommendations

- Avoid excessive intraoperative fluids and intraoperative hypotension with goal-directed fluid therapy. In the postoperative period fluid infusions should be interrupted as soon as possible.
- Prevent PONV with a multimodal approach.
- Be aware of the possibility of difficult airway management.
- Adopt lung protective ventilation.
- Patients should be positioned in order to improve lung mechanics (anti-Trendelenburg, flexed hip, anti- or beach chair).
- Deep neuromuscular block improves surgical performance.
- Neuromuscular blockade should be completely reversed. The use of qualitative monitoring of neuromuscular blockade is encouraged.
- Adopt BIS monitoring of anesthesia depth if end tidal anesthetic gas is not available.
- Laparoscopic surgery is to be preferred.
- Avoid postoperative nasogastric tube if not necessary.

5.2.1.3 Postoperative Recommendations

- Combine infiltration of local anesthetic and multimodal systemic analgesics.
- Consider thoracic epidural analgesia in laparotomic surgery.
- Adopt mechanical and pharmacological measures for thromboprophylaxis.
- Monitor protein intake. Iron, vitamin B12 and calcium supplementation is mandatory.
- Tight glycemic and lipid control in diabetic patients should be adopted.

- Prophylactic supplemental oxygen should be administered (preferably in head-elevated position or in semi-sitting position for patients suffering from obstructive sleep apnea [OSA]).
- Close monitoring of apneic episodes for patients with OSA.
- Consider CPAP if: BMI > 50 kg/m^2, severe OSA or oxygen saturation ≤90% with oxygen supplementation.
- Use patient's CPAP equipment for patients already with CPAP therapy at home.
- Patients with obesity hypoventilation syndrome (OHS) require intensive care monitoring and non-invasive ventilation

5.2.2 Effectiveness of ERAS Protocol in Bariatric Surgery

One of the main differences with respect to other surgical areas is that bariatric surgery generally involves young and physically fit patients, while in the non-bariatric settings the beneficial data are mainly derived from studies in elderly and frail patients. Furthermore, 30-day morbidity and mortality rates in bariatric surgery are relatively low (0.04% and 3% for severe complications, respectively [22]), and further reductions may be difficult to achieve. However, adherence to the ERAS pathway has shown to be feasible even at a national level, and able to improve outcomes [23]. A recent meta-analysis of ERAS protocols in bariatric surgery [24] demonstrated benefits in morbidity ($p < 0.01$), operative time ($p < 0.01$) and hospital length of stay ($p < 0.01$). Although limited by the methodology and quality of the included studies (only 13 studies retrieved, of which just 2/13 were randomized controlled trials and only 5/13 referred specifically to ERAS protocols), the ERAS protocol proved safe and effective. The whole perioperative care, from preadmission to the postoperative period, by a multidisciplinary team and a comprehensive and meticulous approach to the patient promoted by the ERAS protocols seems to be an effective strategy to improve outcomes also in bariatric surgery.

5.3 The ERAS Protocol for Emergency Surgery in Obese Patients

The ERAS protocol has proved to be feasible and effective in a wide range of surgical fields, allowing for better outcomes, fewer complications and cost savings [4]. The ERAS protocol has been successfully and extensively applied also in bariatric surgery, with a positive impact on many relevant outcomes [24].

Besides bariatric surgery, obese patients can require non-bariatric surgery. As a matter of fact, the global obesity epidemic implies that most (or all) anesthetists and theatre staff will have to deal with surgery in obese patients [25]. The optimal management of the obese surgical patients was addressed in recent authoritative guidelines [17, 26] and expert narrative reviews [27]: experienced anesthetic and surgical staff with good hospital organization and appropriate facilities were reported as crucial.

Emergency non-bariatric surgery in obese patients can be challenging. The few available data suggest that this population requires more resources and is at increased risk of complications compared with non-obese patients [28]. Application (as far as possible) of the guidelines for elective obese surgical patients has been proposed, together with the involvement of senior experienced anesthetists and surgeons [25]. To the best of our knowledge, no study to date has evaluated the feasibility, safety and efficacy of the ERAS protocol in emergency non-bariatric obese patients. Due to the emergency of surgery, preadmission and preoperative optimizations might often be not feasible. On the other hand, considering the benefits that were demonstrated in obese patients it seems reasonable to apply as completely as possible all the intraoperative and postoperative ERAS elements. As for the general management of obese surgical patients, a careful application of the ERAS measures is more likely when the staff is experienced in obese patient management and familiar with the ERAS protocol. This means that hospitals performing a high volume of bariatric interventions might offer the best possibility of an optimal implementation of the ERAS protocol in emergency surgical obese patients. However, before recommending centralization of emergency surgical obese patients in bariatric surgery hospitals further studies are required.

References

1. Kehlet H. The surgical stress response: should it be prevented? Can J Surg. 1991;34:565–7.
2. Bardram L, Funch Jensen P, Jensen P, et al. Recovery after laparoscopic colonic surgery with epidural analgesia, and early oral nutrition and mobilisation. Lancet. 1995;345:763–4.
3. Feldheiser A, Aziz O, Baldini G, et al. Enhanced Recovery After Surgery ERAS for gastrointestinal surgery, part 2: consensus statement for anaesthesia practice. Acta Anaesthesiol Scand. 2016;60:289–334.
4. Ljungqvist O, Scott M, Feraon KC. Enhanced recovery after surgery' a review. JAMA Surg. 2017;152:292–8.
5. Greco M, Capretti G, Beretta L, et al. Enhanced recovery program in colorectal surgery: a meta-analysis of randomized controlled trials. World J Surg. 2014;38:1531–41.
6. Fleisher LA, Fleischmann KE, Auerbach AD, et al. 2014 ACC/AHA guideline on perioperative cardiovascular evaluation and management of patients undergoing noncardiac surgery: a report of the American College of Cardiology/American Heart Association Task Force on practice guidelines. Circulation. 2014;130:2215–45.
7. Carlisle JB, Stevenson CA. Drugs for preventing postoperative nausea and vomiting. Cochrane Database Syst Rev. 2006;(3):CD004125.
8. Kuhry E, Schwenk W, Gaupset R, et al. Long-term outcome of laparoscopic surgery for colorectal cancer: a cochrane database systematic review of randomized controlled trials. Cancer Treat Rev. 2008;34:498–504.
9. Nelson R, Edwards S, Tse B. Prophylactic nasogastric decompression after abdominal surgery. Cochrane Database Syst Rev. 2007;3:CD004929.
10. Carli F, Kehlet H, Baldini G, et al. Evidence basis for regional anesthesia in multi-disciplinary fast-track surgical care pathways. Reg Anesth Pain Med. 2011;36:63–72.
11. Miller TE, Roche AM, Mythen M. Fluid management and goal-directed therapy as an adjunct to Enhanced Recovery After Surgery (ERAS). Can J Anesth. 2015;62:158–68.
12. Carli F, Scheede-Bergadhl C. Prehabilitation to enhance perioperative care. Anesthesiol Clin. 2015;33:17–33.

13. Braga M, Pecorelli N, Scatizzi, et al. Enhanced recovery program in high-risk patients undergoing colorectal surgery: results from the Perioperative Italian Society Registry. World J Surg. 2017;41:860–7.
14. Stevens GA, Singh GM, Lu Y, et al. National, regional and global trends in adult overweight and obesity prevalence. Popul Health Metrics. 2012;10:22. https://doi.org/10.1186/1478-7954-10-22.
15. Buchwald H, Oien DM. Metabolic/bariatric surgery worldwide 2011. Obes Surg. 2013;23:427–36.
16. Glance LG, Wissler R, Mukamel DB, et al. Perioperative outcomes among patients with the modified metabolic syndrome who are undergoing noncardiac surgery. Anesthesiology. 2010;113:859–72.
17. Nightingale CE, Margarson MP, Shearer E, et al. Peri-operative management of the obese surgical patient 2015. Anaesthesia. 2015;70:859–76.
18. Hernandez AF, Whellan DJ, Stroud S, et al. Outcomes in heart failure patients after major noncardiac surgery. J Am Coll Cardiol. 2004;44:1446–53.
19. Blokhin IO, Lentz SR. Mechanisms of thrombosis in obesity. Curr Opin Hematol. 2013;20:437–44.
20. Mutter TC, Chateau D, Moffatt M, et al. A matched cohort study of postoperative outcomes in obstructive sleep apnea. Anesthesiology. 2014;121:707–18.
21. Thorell A, MacCormick AD, Awad S, et al. Guidelines for perioperative care in bariatric surgery: Enhanced Recovery After Surgery (ERAS) Society recommendations. World J Surg. 2016;40:2065–83.
22. SOReg – Scandinavian Obesity Surgery Registry Annual Report. 2013. Annual report. http://ucr.uu.se/soreg.
23. Ruiz-Tovar J, Royo P, Munoz JL, et al. Implementation of the Spanish national enhanced recovery program (ERAS) in bariatric surgery: a pilot study. Surg Laparosc Endosc Percutan Tech. 2016;26:439–43.
24. Ahmed OS, Rogers AC, Bolger JC, et al. Meta-analysis of enhanced recovery protocols in bariatric surgery. J Gastrointest Surg. 2018;22:964–72.
25. Cota N, Harris S, Kennedy N. Management of the morbidly obese patient requiring emergency surgery. In: Colvin JR, Peden CJ, editors. Raising the Standard: a compendium of audit recipes. 3rd ed. London: The Royal College of Anaesthetists; 2012. p. 146–7.
26. Petrini F, Di Giacinto I, Cataldo R, et al. Perioperative and periprocedural airway management and respiratory safety for the obese patient: 2016 SIAARTI Consensus. Minerva Anestesiol. 2016;82:1314–35.
27. Kiss T, Bluth T, de Abreu MG. Perioperative complications of obese patients. Curr Opin Crit Care. 2016;22:401–5.
28. Küpper S, Karvellas CJ, Khadaroo RG, Widder SL, Acute Care and Emergency Surgery (ACES) Group. Increased health services use by severely obese patients undergoing emergency surgery: a retrospective cohort study. Can J Surg. 2015;58:41–7.