Brazilian Journal of Anesthesiology 2023;73(1): 36—41

Sociedade Brasileira de Anestesiologia

Brazilian Journal of ANESTHESIOLOGY

ORIGINAL INVESTIGATION

Compliance with Enhanced Recovery After Surgery (ERAS) protocol recommendations for bariatric surgery in an obesity treatment center

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Received 30 May 2021; accepted 2 October 2021
Available online 25 December 2021

KEYWORDS
Bariatric surgery;
Enhanced recovery after surgery;
Perioperative care

Abstract
Introduction: The higher risk of perioperative complications associated with obesity has made anesthesiologists increasingly concerned with the management of obese patients. Measures that improve bariatric surgery patient safety have become essential. The implementation of ERAS protocols in several surgical specialties has made it possible to achieve appropriate outcomes as to surgery safety. The aim of this study was to evaluate patient compliance with the recommendations of an ERAS protocol for Bariatric Surgery (ERABS) at a hospital specialized in obesity treatment.
Methods: Cross-sectional study, using a medical record database, in a hospital certified as an International Center of Excellence in Bariatric and Metabolic Surgery. The definition of the variables to be assessed was based on the most recent ERABS proposed by Thorell et al. Results were analyzed using descriptive epidemiology.
Results: The study evaluated all patients undergoing bariatric surgery in 2019. Mean compliance with the recommendations per participant was 42.8%, with a maximum of 55.5%, and was distributed as follows: 22.6% of compliance with preoperative recommendations, 60% to intraoperative recommendations, and 58.1% to postoperative recommendations. The anesthesiologist is the professional who provides most measures for the perioperative optimization of bariatric surgery patients. In our study we found that anesthesiologists complied with only 39.5% of ERABS recommendations.
Conclusions: Mean compliance with ERABS recommendations per participant was 42.8%. Considering that the study was carried out at a hospital certified as an international center of excellence, the need for introducing improvements in the care of patients to be submitted to bariatric surgery is evident.

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https://doi.org/10.1016/j.bjane.2021.10.018

Introduction

Obesity is a public health problem whose incidence has progressively increased.[1,2] Due to the higher risk of perioperative complications associated with obesity, anesthesiologists are increasingly concerned about the management of obese patients. Consequently, improving bariatric surgery safety has become essential.[3] This explains the current trend toward implementing clinical protocols to optimize the perioperative management of obese patients, such as the Enhanced Recovery After Surgery (ERAS) protocol, aiming to improve outcomes.

The ERAS protocol comprises evidence-based recommendations seeking to reduce perioperative stress triggered by surgical trauma.[4] ERAS recommendations include patient commitment, reduction of surgery-related physiological stress, reduction in postoperative complications, and increase in postoperative recovery rates.[5] The measures are associated with decrease in morbidity, faster recovery, and shorter length of stay.[6] Using ERAS protocols in bariatric surgery patients is associated with significant decrease in postoperative complications and length of stay, and subsequent reduction in hospital costs.[7]

The aim of this study was to assess patient compliance with the recommendations of an ERAS protocol for Bariatric Surgery (ERABS) at a hospital certified as an International Center of Excellence in Bariatric and Metabolic Surgery by the Surgical Review Corporation.

Methods

Design

After approval by the Research Ethics Committee of the institution, CAAE 38295620.0.0000.5369 and opinion 4.356.054, a cross-sectional study was carried out using a database, and both paper and electronic format patient medical charts.

Participants

We evaluated patients submitted to bariatric surgery using gastric bypass or sleeve gastrectomy techniques in 2019, totaling 150 patients. The study included patients over 18 years of age, regardless of sex, submitted to bariatric surgery at the hospital evaluated. No patients were excluded from the study.

Variables

We defined the variables to be evaluated based on the most recent ERABS protocol.[4] They comprised sociodemographic characteristics; pre-existing comorbidities and medications in use; American Society of Anesthesiologists (ASA) classification performed by the anesthesiologist; presence of multidisciplinary team; occurrence of preoperative counseling performed by a psychologist; smoking cessation; difficult airway diagnosed by the anesthesiologist; measurement of preoperative fasting time for clear liquids and solid foods performed by the anesthesiologist; time and type of preoperative medications administered; preoperative oral carbohydrate conditioning; airway device used during surgery; surgery technique; use of Train Of Four (TOF) and Bispectral Index (BIS) monitors intraoperatively; medications used for analgesia and Postoperative Nausea and Vomiting (PONV) prophylaxis; combination of different postoperative analgesia techniques; use of postoperative Nasogastric Tube (NGT); performance of thromboprophylaxis and therapeutic regimen ordered; time liquid diet was initiated; and time participant was discharged. Additionally, we analyzed the immediate complications considering any manifestation reported by the participant or the data entered into the medical chart. We also evaluated hospital readmission within 30 days after surgery, comprising the reason for readmission and its outcome.

Statistical analysis

Categorical variables are presented as absolute frequencies and proportions, and continuous variables as means and standard deviation. The percentage of compliance per participant was calculated using simple arithmetic mean.

Results

Perioperative risk assessment was performed considering sociodemographic characteristics, such as sex, age, comorbidities, medications in use and the anesthesiologist's preanesthesia assessment. Data are presented in Table 1. Mean BMI was 41.9 $kg.m^{-2}$, with minimum and maximum values of 31.4 and 63.2, respectively. Mean age was 37 years (SD 10 years), with minimum and maximum age of 19 and 67 years, respectively.

Regarding the distribution of the multidisciplinary team professionals, a psychologist was present for 95.3% of the participants (n = 143), a nutritionist for 87.3% (n = 131), physical therapist for 78% (n = 117), and a psychiatrist for 3.3% (n = 5). Preoperative psychologist counseling was provided at the hospital for 40.7% of participants (n = 61). None of the participants (n = 0) received instructions regarding hospital discharge on the first postoperative day. Twelve participants were smokers and smoking cessation advice was given to 41.6% (n = 5). Among participants receiving smoking cessation advice, all of them (n = 5) continued to smoke up to the surgical procedure.

Before hospital admission the anesthesiologist performed preanesthesia assessment in 100% of the participants (n = 150) and airway assessment was registered on the medical chart for 72.7% of the participants (n = 109). Of these, 44% (n = 48) did not show any abnormal finding. Among abnormal findings after airway assessment, we registered Mallampati 1 in 55% (n = 60) and Mallampati > 2 in 44.9% (n = 49), neck circumference > 40 cm in 32.1% (n = 35), thyromental distance < 6 cm in 10% (n = 11) and interincisal distance < 3 cm in 3.6% (n = 4). We found the presence of more than one abnormal finding in 22% of participants (n = 24).

Mean fasting time for both clear liquids and solid foods verified by the anesthesiologist was 8 hours. The administration of anesthesia premedication was decided for 40.7% of the participants (n = 61), in decreasing order of prevalence: alpha-2-agonist in 57.3% (n = 35), antiemetic in 44.2% (n = 27), benzodiazepine in 42.6% (n = 26), and H2 antagonist

Table 1 Perioperative risk assessment of the patients submitted to bariatric surgery (n = 150).

	n	%
Sex		
Male	41	27.3
Female	109	72.7
Age		
19–30 years	43	28.7
31–50 years	87	58.0
> 50 years	20	13.3
BMI		
30–34.9	9	6.0
35–39.9	48	32.0
≥ 40	93	62.0
Comorbidities		
Arterial hypertension	50	33.3
Liver steatosis	37	24.7
OSAHS	34	22.7
Diabetes mellitus	29	19.3
GERD	26	17.3
Esophageal hernia	21	14.0
Psychiatric disorder	20	13.3
Dyslipidemia	8	5.3
Others	30	20.0
Medications in use		
Anti-hypertensive	47	31.3
Hypoglycemic	17	11.3
Lipid-lowering drugs	7	4.7
Platelet Antiaggregant	5	3.3
Anticoagulant	1	0.7
Psychotropics	35	23.3
Oral contraceptive	43	28.7
Habits		
Smoking	12	8.0
Alcohol consumption	23	15.3
Not applicable	118	78.7
ASA physical status		
I	3	2.0
II	89	59.3
III	58	38.7

OSAHS, Obstructive Sleep Apnea Hypopnea Syndrome; GERD, Gastroesophageal Reflux Disease; ASA, American Society of Anesthesiologists.

in 40.9% (n = 25). Mean time of premedication administration was 111 minutes before surgery. Preoperative oral carbohydrate conditioning was performed in 2% of the participants (n = 3), and the carbohydrate chosen was maltodextrin (n = 3).

Orotracheal intubation combined with the laparoscopic approach was used for 100% of participants (n = 150). TOF and BIS monitor devices were never used (n = 0), thus monitoring of neuromuscular blockade or depth of anesthesia was absent in all participants. Notwithstanding the latter, neuromuscular blockade reversal was performed in 74% of participants (n = 111) using neostigmine in 91% (n = 101) and sugammadex in 9% (n = 10). We were unable to evaluate protective mechanical ventilation strategies as they were not registered on medical charts.

Multimodal PONV prophylaxis was administered to 95% of participants (n = 141). On the other hand, multimodal analgesia was ordered for 74% of participants (n = 111). Dipyrone was administered to 94.7% of participants (n = 142), and non-steroidal anti-inflammatory drugs to 92% (n = 138), opioids to 88% (n = 132), alpha-2-agonist to 60% (n = 90), magnesium sulfate to 34.7% (n = 52) and ketamine to 33.3% (n = 50). Only three participants (2%) received another drug combination for postoperative analgesia, and surgical wound infiltration was performed in these cases.

Opioids for postoperative analgesia were used in 88% (n = 132) of participants and morphine was the opioid of choice for all of them, with a mean administered dose of 9.6 mg. Rescue medication for postoperative pain control was required for 24% of participants (n = 36). To manage this scenario, 17.3% of participants (n = 26) received opioids such as morphine or methadone, with a mean administered dose of 7.8 mg. Instead, 6.7% of participants (n = 10) received 100 mg tramadol.

None of the patients required a nasogastric tube postoperatively (n = 0). Mechanical methods for thromboprophylaxis were performed in all (n = 150) participants. As to pharmacological thromboprophylaxis, low molecular weight heparin was administered to 91.3% of participants (n = 137) and unfractionated heparin to 8% (n = 12).

The mean time to start the restricted liquid diet was 24.3 hours, and to be discharged from hospital was 2.03 days. Table 2 depicts the prevalence of immediate complications, outcome, and readmission within 30 days. Only one participant (0.6%) required revision surgery during readmission.

Figure 1 presents variables regarding compliance with the measures that are strongly recommended by the ERABS protocol. Mean compliance with the recommendations was 42.81% per participant, with a minimum of 26.32% and a maximum of 55.56%, distributed as follows: 22.6% of compliance with preoperative, 60% to intraoperative and 58.1% to postoperative recommendations.

In addition, we registered the compliance rate with the recommendations according to the professionals involved in patient care. Anesthesiologists are the caregivers with the

Table 2 Perioperative characteristics of patients submitted to bariatric surgery.

	n	%
Immediate complications	86	57.3
Abdominal pain	61	40.7
Nausea	32	21.3
Respiratory distress	4	2.6
Bleeding	2	1.3
Allergy	2	1.3
Fall	1	0.6
Others	6	4.0
Readmission reason	11	7.3
Abdominal pain	10	6.6
Sudden malaise	1	0.6
Outcome		
Discharge	149	99.4
Death	1	0.6

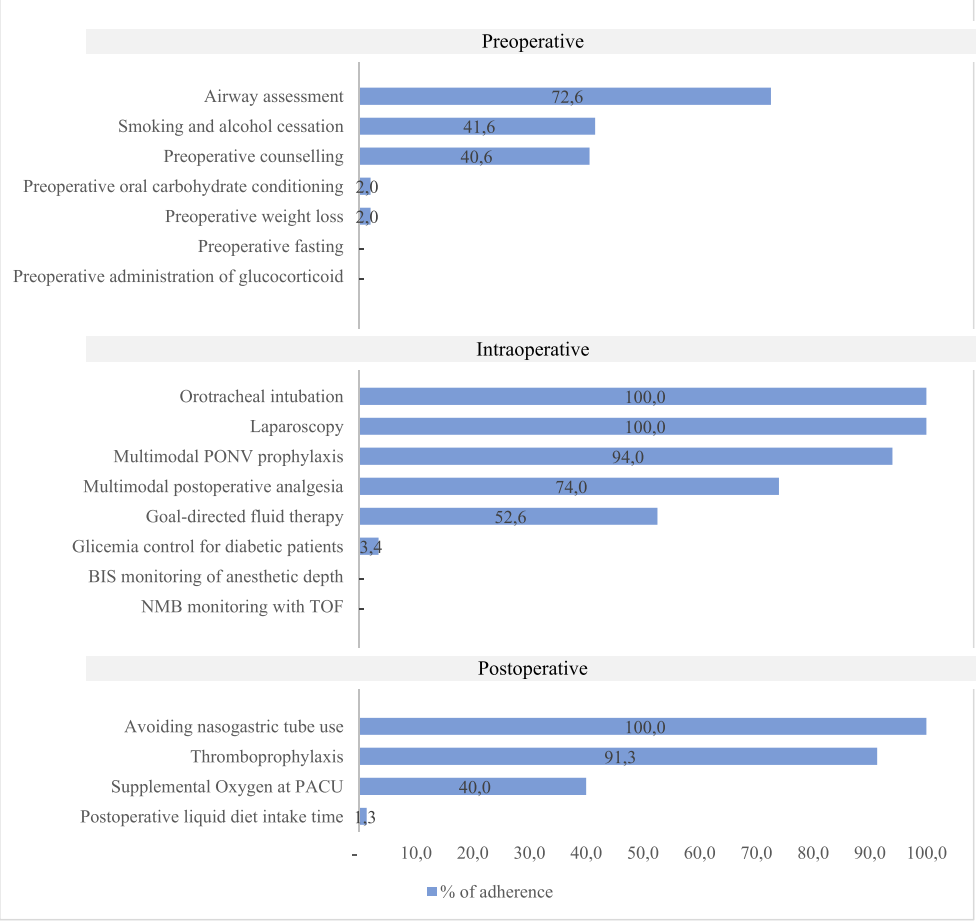

Figure 1 Compliance to measures strongly recommended in the ERAS protocol for bariatric surgery. PONV, Postoperative Nausea and Vomiting; BIS, Bispectral Index; NMB, Neuromuscular Blockade; TOF, Train-Of-Four; PACU, Postanesthetic Care Unit.

highest percentage of recommendations to be complied with, which is 61.1%. In this study, anesthesiologists complied with only 39.1% of the recommendations they were accountable to. Surgeons were the caregivers that achieved the highest rate of compliance with recommendations, or 73.1%.

Discussion

Interest in ERAS protocols have recently increased considerably worldwide. Deficits in teaching and training hospital staff have been revealed,[5] and lack of compliance with existing recommendations is a health concern.[8] The interval between arrival of scientific evidence and its implementation in clinical practice is 15 years on average.[9] Conversely, benefits to patients and institutions are immediate. Therefore, implementing evidence-based recommendations has become the best practice in medicine.

Since 2015, the hospital evaluated in this study has been one of 11 hospitals in Brazil, and the only one in State of Santa Catarina to be certified as an International Center of Excellence in Bariatric and Metabolic Surgery by the Surgical Review Corporation. Despite accreditation and professionals committed to improving their practice and hospital outcomes, implementing recommendations is often challenging.

Patients are followed by a multidisciplinary team from the beginning of treatment at the bariatric surgery unit of the hospital studied. Indeed, multidisciplinary care is crucial to improve surgical outcomes as it facilitates the interaction among intra-hospital processes.[5] Preoperative counselling performed at the hospital was given to less than half of participants. This contrasts with several reports[4,7,10] that have emphasized that preoperative counselling is key to lesser anxiety and improves compliance with postoperative instructions, postoperative recovery, length of stay and long-term outcome.[4] Our study also revealed that the most absent professional in the multidisciplinary team was the physical therapist. This finding contrasts with current recommendations[4,11,12] that emphasize physical therapy as an essential element in the management of surgical patients. This scenario may reveal a transitional period for patient care at the hospital assessed, and at other centers,[11] as the multidisciplinary approach has been gradually appreciated and implemented in surgical patient management.

Smoking cessation was recommended to all smokers. However, less than half of smokers complied with the recommendation. The current recommendation is to stop smoking

at least four weeks before surgery.[4] Continuing to smoke during the preoperative period is associated with both greater morbidity and mortality.[4,13] Particularly in bariatric surgery, there is evidence that smokers have a higher risk of anastomotic ulceration in Roux-en-Y gastric bypass.[7,14]

Preoperative fasting instructions are provided during the preanesthetic consultation. Although we did not register a relevant percentage of compliance, this measure has been already endorsed by anesthesiology societies that currently recommend two hours of fasting for clear liquids and six hours for solid foods in healthy and obese patients.[15] Longer fasting time has a negative effect on overall patient recovery, triggering, for instance, increase in insulin resistance and metabolic consequences.[16] Therefore, it is wise to promote efforts to attain adequate fasting time for the obese patient.[11] However, standardizing and achieving appropriate fasting time is challenging, mainly due to the variability of operating room lists and schedules. Therefore, the goal can be accomplished by an effort to schedule bariatric surgery in the first time slot of the day in the operating room list.

The anesthesiologist is also advised to perform preoperative oral carbohydrate conditioning. This measure is well established for major elective abdominal surgeries and has a strong grade of recommendation.[4] However, further studies are required to evaluate this measure both in bariatric surgery patients with gastroesophageal reflux disease, due to the possible increased risk of bronchial aspiration during anesthetic induction, and in patients presenting diabetes,[7] which may explain the low compliance with the measure in this study and in other centers.[7]

During hospitalization, most of the participants in our study received preanesthetic medication, in disagreement to current protocols[4,7] which emphasize not using premedication, especially benzodiazepines, which represented 42.6% of the premedication ordered in this study. The likely key factor explaining this behavior is the resistance to change of professionals, already reported in other centers.[9] Professionals should be encouraged not to order preanesthetic medication, replacing it by other modalities of preoperative anxiety management, such as the preoperative visit performed by a health professional involved in patient care.

PONV prophylaxis is pivotal, especially if one considers the studied population, which presents a high risk for postoperative nausea and vomiting.[4,17] The population studied presents an additional PONV risk factor, that is high prevalence of using inhaled anesthetic agents for anesthesia maintenance and opioids for postoperative analgesia. Similar to other pre-ERAS studies,[3,18] we did not observe compliance with the ERABS[4] protocol recommendation of preoperative glucocorticoid administration. Possibly, the major determining factor is the operational challenge in delivering this measure. Thus, studies to evaluate implementation have decided to include the administration of glucocorticoids during anesthetic induction.[3,7]

Anesthetic care in the perioperative period is not limited to providing anesthesia, but also comprises postoperative pain management.[16] Consequently, multimodal analgesia is another recommendation described. Despite having found a high compliance rate of 74%, the recommendation is to provide postoperative analgesia whenever possible.[4] The main objective is to reduce the consumption of narcotics,[7,19] which was not found in this study, as both the rate of opioid use and the mean dose per participant were high. We reported a lower prevalence use of other groups of drugs, such as alpha-2-agonists, ketamine, and magnesium sulfate. Indeed, despite the disadvantages of opioid administration and the emergence of scientific evidence advising to use other drugs, opioids have not yet been completely replaced in the treatment of moderate to severe acute postoperative pain,[20] justifying the high prevalence of use. Consequently, a current attempt is being made to combine techniques, such as surgical wound infiltration or transverse abdominal plane block.[4,16,20]

Another extremely important element of perioperative optimization is the intraoperative monitoring of anesthetic depth and neuromuscular blockade. The hospital studied does not have the equipment to carry out this monitoring, explaining the non-compliance with this recommendation. The barriers our hospital administration met for implementing new technologies were costs, technical support and maintenance, and resistance to change, like those observed in other centers.[21]

In this study the ERABS compliance rate per participant is considered low and comparable to the rate found elsewhere.[8,22] As the ERABS protocol spreads and efforts are made to incorporate its elements into clinical practice, a significant increase in ERABS compliance is expected. It is essential that health institutions assess behaviors and outcomes to subsequently analyze and correct errors to enhance their outcomes. The most complex recommendations to be implemented depend on the integration and support of the hospital administration, reflecting, in part, professionals' challenges to match their practices with current evidence. Considering that this study was carried out at a hospital certified as a center of international excellence, the need to introduce improvements in the care of patients undergoing bariatric surgery becomes evident.

Anesthesiologists are the chief players and proponents of those changes inside hospital organization. In addition to being accountable for the highest number of elements in perioperative optimization of bariatric surgery patients, the anesthesiologist is also responsible for the patient's overall recovery and, thus, plays a role as a modifier of hospital outcomes. Studies evaluating the implementation of perioperative optimization protocols in colorectal surgery[23] have shown that anesthesiologists are essential to promote perioperative optimization, and their main measures independently associated with reduction in hospital stay are multimodal PONV prophylaxis, standardized use of non-steroidal anti-inflammatory drugs for postoperative analgesia, and strict compliance with a postoperative opioid administration protocol. These are everyday acts and, therefore, they often become trivialized, underestimating their relevance to patient recovery. Anesthesiologists' role can be extended to several aspects of surgical patient care and should not be circumscribed to delivering anesthesia. Thus, the need to include anesthesiologists more in several elements of surgical patient management is evident.

This study reveals how challenging it is to implement perioperative optimization measures in the bariatric surgery clinical pathway. One limitation of the study was the use of secondary data; thus, it is essential to proceed with further analysis using primary data. As a reference center for bariatric surgery, the service receives patients from different locations, which is a bias for the analysis of some variables, such

as preoperative care and hospital readmission, which may have occurred in facilities other than the hospital studied.

Conclusion

The mean ERABS compliance rate per participant was 42.8%. Considering that the study was carried out at a hospital certified as an international center of excellence, the need for improvement in the care of patients to be submitted to bariatric surgery is evident. The anesthesiologist is the professional accountable for most of the measures that impact the perioperative optimization of bariatric surgery patients, and should be seen, increasingly, as a protagonist in the management of these patients.

Conflicts of interest

The authors declare no conflicts of interest.

Supplementary materials

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.bjane.2021.10.018.

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