



The European Perioperative Medical Networking (EUPEMEN) project and recommendations for perioperative care in colorectal surgery: a quality improvement study

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Background: Despite consensus supporting enhanced recovery programs, their full implementation in such a context is difficult due to conventional practices within various groups of professionals. The goal of the European Perioperative Medical Networking (EUPEMEN) project was to bring together the expertise and experience of national clinical professionals who have previously helped deliver major change programs in their countries and to use them to spread enhanced recovery after surgery protocols (ERAS) in Europe. The specific aim of this study is to present and discuss the key points of the proposed recommendations for colorectal surgery.

Materials and methods: Five partners from university hospitals in four European countries developed the project as partners. Following a non-systematic review of the literature, the European consensus panel generated a list of recommendations for perioperative care in colorectal surgery. A list of recommendations was formulated and distributed to collaborators at each center to allow modifications or additional statements. These recommendations were then discussed in three consecutive meetings to share uniform ERAS protocols to be disseminated.

Result: The working group developed (1) the EUPEMEN online platform to offer, free of charge, evidence-based standardized perioperative care protocols, learning activities, and assistance to health professionals interested in enhancing the recovery of their patients; (2) the preparation of the EUPEMEN Multimodal Rehabilitation manuals; (3) the training of the trainers to teach future teachers; and (4) the dissemination of the results in five multiplier events, one for each partner, to promote and disseminate the protocols.

Conclusion: The EUPEMEN project allowed the sharing of the expertise of many professionals from four different European countries with the objective of training the new generations in the dissemination of ERAS protocols in daily clinical practice through a new learning system. This project was proposed as an additional training tool for all the enhanced recovery program teams.

Keywords: colorectal surgery, enhanced recovery after surgery, EUPEMEN project, perioperative care, training and dissemination

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Introduction

The enhanced recovery after surgery (ERAS) program is a scientific evidence-based perioperative care approach centered on a multidisciplinary team aimed at improving postoperative outcomes and reducing recovery time in surgical patients by attenuating the perioperative metabolic response and organ dysfunction, especially in colorectal surgery^[1,2]. Despite consensus and clinical evidence supporting ERAS^[3–6], its full implementation in such a context is difficult because perioperative management is still strongly related to conventional practices among various groups of professionals. A consensus review of perioperative care in colorectal surgery was performed fifteen years ago in 2009 by the ERAS group^[6], and the key message across the years is that the immediate challenge to improving the quality of surgical care is not discovering new knowledge but rather how to integrate what we already know into practice. Here are some of the difficulties often encountered during the implementation of ERAS protocols: resistance to change, cultural and organizational barriers, multidisciplinary coordination, resource allocation, standardization, patient education and monitoring. The current project describes a method of close collaboration among several European hospitals to develop protocols and create platforms for their dissemination.

The goal of the European PErioperative MEdical Networking (EUPEMEN) project was to bring together the expertise and experience of national clinical professionals who have previously helped to deliver major change programs in their countries and to use them to spread the ERAS protocols in Europe in specific subject areas of surgery. The group was created to develop a standardized educational ERAS protocol that could be disseminated through a learning website platform to help healthcare professionals interested in implementing evidence-based ERAS protocols in a homogeneous and standardized manner. The EUPENEM supported the ERASMUS+ program (Agreement number 2020-1-ES01-KA203-082681).

The specific aim of this study was to present and discuss the key points of the proposed protocol for colorectal surgery in the EUPEMEN project.

Methods

Five partners from university hospitals in four different EU countries have developed the EUPEMEN project as partners; namely the Fundación Instituto de Investigación Sanitaria Aragón-IISA (Spain) as coordinator, Azienda Unità Sanitaria Locale Ferrara-AUSLFE (Italy), Univerzita Karlova-CUNI (Czechia), Universidad Miguel Hernández de Elche-UMH (Spain), and “G. Papanikolaou-GPAP” General Hospital of Thessaloniki (Greece). The main objective of the EUPEMEN project was to create and disseminate protocols for multimodal surgical rehabilitation based on the experience and previous knowledge of the five partners in the health field and higher education.

Following a targeted review of the literature, the European consensus panel generated a list of recommendations for perioperative care in colorectal surgery. In 2015, The *Clinical Pathway for Intensified Recovery in Abdominal Surgery (RICA)* was published in close collaboration with other scientific organizations, offering an interdisciplinary consensus document to improve postoperative recovery, maintain patient safety, and

HIGHLIGHTS

- The EUPEMEN online platform offers, free of charge, evidence-based standardized perioperative care protocols, learning activities, and assistance to health professionals interested in enhancing the recovery of their surgical patients.
- The project was feasible and was proposed as an additional training tool for all enhanced recovery program teams.
- The long-term and clinical impact of the project will be to decrease postoperative complications, length of hospital stay, and healthcare costs.

ensure optimal resource usage^[7]. A list of recommendations was formulated and distributed to collaborators at each center to allow modifications or additional statements. These recommendations were then discussed in three consecutive meetings to share a uniform ERAS protocol to be disseminated and reduce clinical practice variability. The study has been reported in line with the Standards for QUality Improvement Reporting Excellence (SQUIRE 2.0)^[8], Supplemental Digital Content 1, <http://links.lww.com/JS9/C525>.

The EUPEMEN protocol for colorectal surgery was structured as follows: (1) a preoperative phase involving all professionals participating in this stage; (2) the perioperative phase encompassing the immediate preoperative period, intraoperative and immediate postoperative phases, including the stay in the intensive care unit (ICU); and (3) the postoperative period extending until postoperative day 3 (POD 3) and discharge of the patient.

The target groups included not only health professionals directly responsible for the care of surgical patients (i.e. surgeons, anesthesiologists, and nurses) but also all professionals connected to the interdisciplinary treatment of these patients. This includes dietitians, stoma therapists, physiotherapists, geriatricians, radiotherapists, oncologists, and pathologists, among others.

Results

The technical activities of the EUPEMEN project were structured as follows:

- (1) Preparation of the *EUPEMEN Multimodal Rehabilitation manual* with the protocols of seven different modules translated into five different languages (English, Spanish, Italian, Greek, Czech): (a) esophageal surgery, (b) gastric cancer surgery, (c) liver resection, (d) bariatric surgery, (e) colorectal surgery, (f) acute appendicitis, and (g) bowel obstruction (<https://eupemen.eu/eupemen-manuals/>).
- (2) The development of the EUPEMEN online platform (<https://eupemen.eu/>, accessed on 24 April 2023) to offer free, evidence-based standardized perioperative care protocols, learning activities, and assistance to health professionals interested in enhancing the recovery of surgical patients.
- (3) The training of the trainers to teach the future teachers the different protocols to be able to teach them in the different hospitals;
- (4) The dissemination of results in five multiplier events, one for each partner, to promote and disseminate the protocols, as shown in Figure 1.



Figure 1. The dissemination of the results in five multiplier events, one for each partner, to promote the protocol.

- (5) The organization of four transnational meetings, one per participating country;
- (6) The revision of the English version of the *Recovery Intensification for optimal Care in Adult's surgery (RICA)*^[7], a care plan developed by the *Grupo Español de Rehabilitación Multimodal (GERM)* and the Spanish Ministry of Health, Social Services and Equality, which aimed to reduce clinical practice variability.

The specific objectives of the project were the development of the EUPEMEN Protocol Training Program for health professionals and the training of at least 200 multidisciplinary professionals in all the direct target groups involved in perioperative care through one local forum from each partner with 40 participants. Furthermore, the implementation of the protocols in at least five hospitals in Europe, the creation of a professional network with the capacity to train stakeholders in hospitals, and to audit the trainers to guarantee the correct implementation of the program. The application of the proposed protocols was assessed by periodic auditing in each center, and the result was a progressive implementation of the program in daily clinical practice through multidisciplinary involvement.

The long-term and clinical impact of the project will be to decrease postoperative complications. Consequently, it aims to reduce morbidity and mortality after surgery, as well as to achieve

faster patient recovery and shorten the length of hospital stay. In turn, this is expected to save money for the public health system.

The EUPEMEN protocol in colorectal surgery (Appendix 1, Supplemental Digital Content 2, <http://links.lww.com/JS9/C526>).

Preoperative phase

In the preoperative phase, complete and fully explained counseling with comprehensive medical assessment is an essential step. Patients should receive complete verbal and written information on what is required to improve their recovery after surgery using informative brochures or flyers. The information must be individualized, adapting it to the characteristics of each patient (comprehension capacity, cultural level, etc.). It is known that a large part of the verbal information provided to patients in the preoperative period is forgotten; sometimes, less than 25% of the information provided is remembered, especially that related to preoperative medication^[9-11]. For patients over 65 years of age, a frailty assessment should be performed^[12,13], as well as an anesthesiologist risk score. The risk of postoperative nausea and vomiting should be assessed using the Apfel score, as shown in Figure 2^[14]. All chronic diseases should be optimized before surgery. All cases of recent-onset or active cardiovascular disease should be evaluated by a cardiologist^[15]. Blood glucose and HbA1c levels should be investigated, and all cases of poorly

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APFEL SCALE
POSTOPERATIVE NAUSEA AND VOMITING PROPHYLAXIS
APFEL MODEL FOR RISK STRATIFICATION

RISK FACTORS	SCORE	RISK
Woman	1	Base line: 10%
Non smoker	1	1 point: 20%
Previous PONV or kinetosis history	1	2 points: 40%
Postoperative opioid usage	1	3 points: 60%
		4 points: 80%
Low risk (0-1 point, 10-20%); moderate (2 points, 40%); high (3-4 points, 60-80%)		

Figure 2. Apfel scale for postoperative nausea and vomiting prophylaxis. PONV, postoperative nausea and vomiting.

controlled or previously undiagnosed diabetes should be referred to a diabetologist before surgery^[16]. In this phase, the management of anemia and iron deficiency is mandatory. Perioperative anemia is now recognized as strongly and independently related to postoperative mortality (adjusted odds ratio 2.36) as well as blood transfusions^[17,18]. Iron deficiency anemia should ideally be managed by parenteral iron administration, considering the urgent characteristics of colonic resection. Nutritional screening should be performed, and we suggest the Malnutrition University Screening Tool (MUST) for feasibility in clinical practice^[19]. Patients at risk of malnutrition should receive oral nutritional supplements, preferably immunonutrition, for 7 days before and 5 days after surgery. According to the ESPEN Clinical Guidelines on Clinical Nutrition and Surgery 2017, specific formulas with immunonutrients should be administered in the peri- or at least postoperative stage in malnourished patients undergoing major surgery for cancer, with an intermediate grade of recommendation^[20]. There is no clear evidence for its use compared to standard oral supplements exclusively in the preoperative period^[21,22]. Smoking must be abandoned, as well as the reduction of alcohol consumption at least 1 month prior to surgery, as they negatively affect the patient's recovery after surgery^[23,24]. Concerning intestinal preparation, a low-residue diet is recommended at least five days before surgery, and two cleaning enemas in the afternoon before surgery in left-sided procedures^[25]. Preoperative intestinal preparation has been a dogma for decades; however, since the 1990s, scientific evidence has raised doubts about its effectiveness. Traditionally, its rationale is based on reducing the consistency and volume of fecal matter, and consequently, bacterial colonization, thereby reducing the risk of postoperative complications, such as anastomotic leakage and wound infections. Other advantages include facilitating minimally invasive surgical dissection and, if necessary, adequate intraoperative endoscopic assessment. On the other hand, disadvantages of preparation include fasting, preoperative hydro-electrolytic imbalances, and dehydration, especially in elderly patients, while the liquid consistency of the face itself could be a risk factor for anastomotic leaks and intraoperative contamination. Current evidence does not support the use of mechanical bowel preparation before surgery in colonic resections but should be used in rectal surgery (high-quality evidence and strong recommendation)^[25]. Therefore, according to the

EUPEMEN protocol, mechanical bowel preparation alone is not recommended, except for perioperative colonoscopies.

Immediate preoperative phase

This phase involves anesthetists, surgeons, nurses, nutritionists, and stoma therapists. Preoperative hygiene is very important, and the patient is instructed to take a full shower or bath the evening or morning before surgery^[26,27]. The site where the incision is performed should be shaved with an electric razor if necessary. Current recommendations suggest that in the event of deciding to remove the hair, it is better to do it close to the intervention but always outside the operating room^[28]. Thromboembolic prophylaxis is characterized by two combined actions: (a) the use of compression stockings or intermittent pneumatic compression that should be worn from admission to hospital discharge; and (b) the use of low molecular weight heparin (LMWH) that should be administered 2–12 h before surgery, according to patients' characteristics and adequate dosage. The application of different thromboprophylaxis measures has shown a reduction in thrombotic risk, with different degrees of efficiency and safety in major abdominal surgery^[29,30]. Preoperative oral carbohydrate loading is a well-established strategy to reduce surgical stress and modulate insulin resistance during and after surgery^[31,32]. A drink high in carbohydrates (12.5% maltodextrins) 800 ml should be administered in the evening before surgery and 400 ml 2 h prior to anesthesia. Oral intake of carbohydrate-rich beverages up to 2 h before surgery is safe and not associated with an increased risk of aspiration^[33,34]. For patients with diabetes, this is administered together with antidiabetic medication. Oral preoperative carbohydrate loading in diabetic patients does not delay gastric emptying nor does it increase the risk of hyperglycemia or aspiration^[35,36]. Preoperative fasting for 6 h for solids and 2 h for clear liquids is recommended^[37]. Prophylactic administration of antibiotic 30–60 min before incision is mandatory, and the type of antibiotics should be chosen according to the local hospital policy^[38,39]. In prolonged procedures, doses are repeated according to the half-life of the drug. Stoma marking (if expected) should be performed by a stoma therapist before the surgery.

Intraoperative phase

The WHO Surgical Safety Checklist should be completed before the incision is made to correctly identify the patient, anesthesia risk, estimated blood loss, and duration of surgery, as it increases patient safety^[40]. During this specific period, both the surgeon and anesthesiologist are involved. Short-acting agents (i.e. propofol, remifentanyl, dexmedetomidine, and inhalation anesthetics) should be used to induce and maintain anesthesia^[25]. Central venous and invasive arterial catheters are not routinely required. Routine intraoperative monitoring includes vital functions, FiO₂ with adequate oxygenation (patients should receive oxygen with an FiO₂ of more than 50%), anesthesia depth, neuromuscular blockade, and glycemia monitoring during surgery. Hemodynamic optimization using goal-directed fluid therapy with validated devices is recommended in high-risk patients and in patients undergoing surgery with large blood loss^[41,42]. In all other cases, restrictive fluid therapy is recommended based on ideal weight in continuous perfusion and balanced solution (1–3 ml/kg/h for laparoscopy; 3–5 ml/kg/h for laparotomy)^[41,42]. Blood loss should be compensated with a 1:1 colloid. The corporeal temperature should be monitored, and normothermia

should be maintained by active heating (heated infusions and thermal blankets)^[43,44]. However, normothermia control should be started in the ward using a thermal blanket. Prophylaxis for postoperative nausea and vomiting (PONV) is recommended according to the specific protocol in every hospital, paying attention to patients^[14]. Concerning pain control in the perioperative phase, thoracic epidural analgesia with combined anesthesia should be performed in all patients undergoing major open abdominal surgery^[45]. However, in laparoscopic surgery it is not routinely recommended. Patients undergoing minimally invasive procedures or with contraindications for epidural analgesia and those at risk for postoperative renal failure or coagulopathy could benefit from bilateral transverse abdominis plane block, infiltration trocars with a local anesthetic, or other alternatives to epidural analgesia^[46]. Nasogastric tube and abdominal drains should be avoided as much as possible. The nasogastric tube was always positioned in the operating room and removed at the end of surgery.

Immediate postoperative phase

The immediate postoperative phase, which could be performed in the ward or in the resuscitation/intermediate care unit, is characterized by the maintenance of FiO₂ 0.5% for 2 h after surgery and normothermia. Pain control is a key factor in enhanced recovery strategies. Active or preventive multimodal analgesia should be used to control the pain. The use of opioids should be reduced with the main objective of reaching a visual analog scale (VAS) score of less than 3. In different studies, opioid-free anesthesia has been shown to reduce the side effects of opioids, such as nausea and vomiting^[47,48]. Fluid therapy must be restricted, and prophylaxis for nausea and vomiting should be continued. Regarding thromboembolic prophylaxis, it is advisable to administer LMWH for at least 12 h after surgery. Good perioperative glycemic control is recommended, paying attention to diabetic patients or those with impaired fasting glycemia, according to local hospital protocols. The use of intensive insulin therapy must be avoided because of the high risk of hypoglycemia during the perioperative period, which can lead to increased mortality^[49,50]. The consensual range of blood glucose levels should be between 150 and 180 g/dl^[49,50]. In this phase, patients should be encouraged to take oral fluid from 6 h after surgery if they do not manifest symptoms of nausea and vomiting. Early mobilization is recommended; patients are encouraged to sit up by 3 h after surgery, and they should begin ambulation 8 h after surgery with respect to night time hours for sleeping.

Postoperative days (POD) 1–3

This represents an important step in which collaboration between patients, nurses, and surgeons is relevant. The main tasks for patients are: (a) early mobilization by starting to move from bed to bedside chair; (b) early feeding with liquid or semi-solid diet depending on patients' tolerance; and (c) respiratory physiotherapy with breathing device four to six times a day^[51,52]. The primary tasks for nurses involve adequate pain control, urinary catheter removal (usually on POD 1-2), and the administration of prescribed medications in the postoperative period (thrombotic prophylaxis and anti-ulcer therapy). Blood tests, including C-reactive protein, should be performed on POD 1–3, to assess a possible increase in inflammatory indexes. From POD 3, the patients were evaluated for early discharge. The adopted

parameters for patient recovery were as follows: (1) complete oral feeding recovery, without any restriction; (2) complete gastrointestinal recovery, defined as the time taken for patients to tolerate solid food and to pass stool; (3) complete pain control with oral analgesics (i.e. Numerical Rate Scale ≤ 3); (4) return to complete mobilization after surgery; (5) no local or systemic signs of infection; and (6) acceptance from the patient.

Post-discharge

On discharge, patients should be given personalized, understandable, and complete information on hospital stay and recommendations for home^[53,54]. Thromboembolic prophylaxis should be continued for 28 days after surgery^[55]. Patients should be followed up in the first week after discharge in an outpatient setting or by telephone. Further check-up visits should be planned for 1, 3, and 6 months after discharge.

Discussion

The introduction of enhanced recovery programs into clinical practice has been pioneered as fast-track surgery by Henrik Kehlet and colleagues in the mid-1990s^[1,2], with the principal objective of optimizing the postoperative outcomes of surgical patients. This protocol was initially used in urban and academic tertiary care centers, and many hospitals began to adopt it, with slow progressive dissemination from Northern Europe and North America throughout the world. The core guidelines established by Kehlet were delineated by consensus review^[6], until the emergence of the Enhanced Recovery After Surgery (ERAS) society in 2010^[56]. The simple publication and dissemination of the recommendations of ERAS protocols does not imply their effective translation into clinical practice or their correct and systematic use^[57]; it is not a spontaneous process. The recommendations are approximations that need to be adapted to the local context in which the protocol is implemented^[58,59]. The implementation and incidence of enhanced recovery programs for colorectal surgery have varied across Europe. In a multi-center study assessing the implementation of the ERAS program in Switzerland and Sweden, the main barriers were time constraints, reluctance to change, and logistic issues^[60]. In 2019, an Italian study called the Piemonte EASY-NET project analyzed the potential obstacles to ERAS application between hospitals already adopting it and the rest of community hospitals in a region of northwest Italy and found that the average level of compliance with the ERAS protocol was 56% among non-ERAS centers and 80% among ERAS ones, with a difference of 24%^[61]. Moreover, for both groups of centers, the lowest level of compliance was recorded for postoperative items^[61]. Recently, Pilkington *et al.*^[62] developed and proposed an integration between ERAS and the Surgical Safety Checklist to implement an enhanced recovery program in clinical practice. However, local ERAS teams from different hospitals were trained to implement ERAS processes. Moreover, an audit of process compliance and patient outcomes are important features^[63]. For this reason, we decided to design the EUPEMEN project, a multi-center European project funded by the EU, with the principal aim of training the new generations that will be future teachers and to disseminate the ERAS recommendations in order to implement and improve the application of enhanced recovery programs in daily clinical practice. The creation of a teaching and learning

platform has allowed the collaboration and cooperation of participants by collecting data on hospital stays and perioperative surgical care across Europe. Effective teamwork and communication are crucial components of the ERAS training. The involvement of a multidisciplinary team necessitates clear communication channels and collaboration to ensure seamless care throughout the patient's surgical journey^[64]. This project has allowed the establishment of an international collaborative research group to increase the power of studies on the perioperative care of surgical patients. Evaluation of the implementation results was also proposed as a secondary objective through the analysis of established indicators and comparison of previously known clinical results with those from the new program, both in the short and long term.

Limitations

This study has some limitations. The preparation of the EUPEMEN Multimodal Rehabilitation manual was limited to only the seven most common modules, chosen by the experts. The long-term clinical impact of the study was not assessed at this time, but this is expected to improve postoperative outcomes and accordingly save money for healthcare system.

Conclusion

The EUPEMEN project allowed the sharing of the expertise and experience of many professionals from four different European countries with the single objective of training the new generations in the dissemination and correct application of the ERAS protocols in daily clinical practice through a new learning system. This project was feasible and proposed as an additional training tool for all enhanced recovery program teams.

Ethical approval

Not applicable.

Informed consent statement

Not applicable.

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Author contribution

A.P., J.M.R., C.V.F., O.I., P.K., A.R., L.S.G.: study concept and design, writing the paper, validation and supervision; N.F., J.M. U., A.P.B., A.R., L.S.G., A.W., P.K., K.R., O.I., S.B., S.S., E.A., C. V.F.: study concept, data collection, data analysis and interpretation; A.B.E.: data analysis and interpretation and project administration; M.T.F.: project administration;

Conflicts of interest disclosure

The authors declare that they have no conflicts of interest.

Research registration unique identifying number (UIN)

Not applicable.

Guarantor

All authors.

Data availability statement

The data presented in this study are available at [<https://eupemen.eu/>, accessed on 24 April 2023].

Provenance and peer review

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Not applicable.

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