Review Article

Nutritional support for perioperative patients in China: progress with ERAS

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The prevalence of malnutrition in surgical patients is high, particularly in elderly, oncologic, critically ill and morbidly obese patients. In recent years, as the concept of enhanced recovery after surgery (ERAS) has gained in popularity, the concept and strategy of nutritional care for surgical patients has also evolved. The concept of nutritional management is relatively new in surgical patient management, which promotes integrating the "nutritional screening-assessment-diagnosis-treatment" (NSADT) scheme into the preoperative, intraoperative, postoperative, and post-discharge processes of disease treatment and rehabilitation. This article will review the practice of perioperative nutrition management in surgical patients in China.

Key Words: perioperative, nutritional support, ERAS

INTRODUCTION

Perioperative nutritional management is important for patients throughout the three periods of preoperative preparation, intraoperative management, and postoperative rehabilitation. Perioperative total nutrition therapy should help maintain the normal organ, tissue and the immune system function, reduce the incidence of infection-related complications, promote organ and tissue recovery, improve surgical tolerance, accelerate patient recovery, and reduce costs.[1,2] Due partly to a lack of nutrition knowledge among clinicians, however, malnutrition occurs in 9 to 44% of perioperative patients, in association with decreased dietary intake, increased energy and protein needs, increased muscle loss, and inflammatory responses.[3,4] Wischmeyer et al. found that malnutrition occurred in up to 65% patients undergoing surgery for cancer or gastro-intestinal disease.[5] The incidence of malnutrition is more pronounced in gastrointestinal surgery patients with the sometime combination of older age, malignancy, underlying severe disease, and morbid obesity.[6]

Risk factors for perioperative malnutrition include age, clinical stage, preoperative comorbidities, preoperative weight loss, and open surgery.[7,8] Before operation, 2.3% of gastro-intestinal patients experience severe malnutrition whereas the prevalence increases to 26.3% after surgery.[7] Perioperative malnutrition has also been associated with higher rates of mortality, morbidity, healthcare costs, and hospital stay duration.[9] Therefore, perioperative nutritional support and management should provide surgical patients a faster and more complete recovery.

DEVELOPMENTS IN PERIOPERATIVE NUTRITIONAL SUPPORT (PNS)

Malnutrition is a longstanding issue for surgical patients and a history of some 70 years of various forms of perioperative nutritional support. Mendelson's reported necessity of abstinence from foods and beverages before surgery, along with the practice of 12- and 6-hours' preoperative fasting for food and drink have been widely adopted. Cestonaro et al. investigated preoperative and postoperative fasting periods and their determinants in patients undergoing elective surgery and found that fasting hours for solids (median 16.50, 5.50 – 56.92) and liquids (median 15.75, 2.50 – 56.92) were indistinguishable in practice.[10] The length of preoperative fasting time had to do with the time of surgery and instructions issued, whereas postoperative fasting period (median 15.67, 1.67 – 90.42) was influenced by surgery type and the level of collaboration between clinical departments and the nutrition and dietetics department. Moreover, it was found that prolonged fasting and abstinence from food and drink increased preoperative anxiety, and postoperative insulin resistance, so that patients were prone to postoperative hyperglycemia and an increased incidence of post-

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operative infection. Since perioperative nutritional support, mainly parenteral nutrition (PN), has developed, these nutritional problems have been understood and somewhat resolved. Animal experiments and clinical studies, often in infants have contributed to this progress.[11,12] The shortcomings of total parenteral nutrition (TPN) have become apparent. The long-term use of TPN leads to dysfunction or damage of the intestinal mucosal barrier, with bacterial translocation. TPN has the added complication of bypassing splanchnic and hepatic nutrient metabolism, and the need with risk for intravenous catheters. The use of PN has decreased markedly, and the ratio of parenteral nutrition to enteral nutrition has changed from 8:2 to 2:8 in clinical practice.[13]

Enhanced recovery after surgery (ERAS) is a collection of evidence-based practices for perioperative patient management. It aims to accelerate patient recovery after surgery and minimize both physical and psychological damage. In 1999, the American Society of Anesthesiologists published guidelines making a statement to reduce the duration of fasting in patients undergoing elective surgery.[14] Later in 2010, the foundation of the ERAS® Society brought more attention to accelerated rehabilitation surgery, leading to a series of guidelines and expert consensuses. On the other hand, ERAS was introduced to clinical practice in China as late as in 2007 under the terminology of fast-track surgery (FTS).[15] In 2015, the China Collaborative Group for Accelerated Rehabilitation Surgery (CCRRS) was established and has become the second FTS collaborative group in the world after the European ERAS Association. More details regarding the history of ERAS around the world and in China can be found in Figure 1.

SCIENTIFIC AND EVIDENCE-BASED PNS

ERAS is an extension of the field of minimally invasive surgery and is a new treatment and rehabilitation model in modern medicine. ERAS emphasizes on minimal invasion, teamwork, evidence-based medicine, perioperative concepts, optimization of the efficiency ratio, accelerated recovery, and social benefits. By optimizing various perioperative treatments, it reduces trauma and stress associated with surgery, thereby accelerating patient recovery.

Nutritional management, as an integral part of the ERAS concept, supports the rapid recovery process of patients. We searched the China National Knowledge Infrastructure (CNKI) with the keywords (Topic=Accelerated Recovery Surgery) OR (Topic=Fast Track Surgery) OR (Topic=Fast Track Process) OR (Topic=Fast Recovery) OR (Topic=Accelerated Recovery) AND (Topic=Nutrition). A total of 1528 articles were retrieved, including a total of 794 research articles. A Web of Science database search for keywords “Enhanced Recovery after Surgery AND nutrition” or “Fast Track Surgery AND nutrition” yielded 576 hits. The language was limited to English and the type of literature was limited to “article”. Review articles (n=427) were removed and a final list of 149 articles were retrieved.

The number of English language articles on ERAS nutritional management peaked in 2020. A cluster analysis was performed in Citespace and the modularity Q value was 0.3572; weighted mean Silhouette S was 0.7037. Significance of clustering results was confirmed based on a weighted mean Silhouette S value greater than 0.3.[16] For studies on the nutritional management of ERAS, a cluster analysis of the English literature showed good significance, as shown in Figure 2. The top 5 disease categories in the included literature were colorectal surgery, gastrointestinal surgery, bladder cancer, esophageal cancer, and cardiac surgery.

Recent studies have shown that nutritional support plays a positive role in the management of ERAS in a wide range of diseases and is safe and effective. Several research or medical institutes are currently making recommendations for ERAS nutritional management, such as ERAS Society Guidelines. Many national guidelines recommend a routine diet until 1 day before surgery for patients without gastrointestinal motility disorders, followed by carbohydrate drinks 2-3 h before anesthesia. The recommendation aims to reduce the catabolic effects of fasting and surgery, maintain glycogen reserves, reduce insulin resistance, and maintain normal bowel function. Several studies have found that preoperative oral carbohydrate fluids improve preoperative comfort surgery, shorten hospital stays and reduce the incidence of postoperative complications.[17-19]

ERAS PRACTICE IN DEPARTMENT OF NUTRITION

Nutritional management of ERAS can be divided into 3 sections, including preoperative education and nutrition therapy for patients, intraoperative hydration, and postoperative rehabilitation, as shown in Figure 3. To facilitate nutritional management, it is essential to establish a nutritional management team, including dietitian, surgeon, anesthetist, nurse practitioner, and psychologist. This team will be responsible for developing an individualized nutritional support programme for the patient. The clinical practice has been concluded as follows:

Preoperative nutritional risk screening & nutritional assessment

Despite increasing clinical use of ERAS, some patients fail to recover quickly after surgery. This is due to wide variations in patient’s preoperative physiological conditions, nutritional status, and co-morbidities. Therefore, a thorough assessment of the patient should be carried out prior to ERAS. Currently, elective surgery patients are routinely screened for nutritional risk using Nutritional Risk Screening 2002 (NRS 2002). For patients under nutritional risk (NRS 2002 score $\geq$3), a dietitian should be consulted. The dietitian is required to develop an individualized nutritional plan that includes nutritional assessment (anthropometry, biochemical assessment, clinical examination, dietary, and economic & social status), nutritional diagnosis (The Global Leadership Initiative on Malnutrition), nutritional intervention, and further monitoring.[20]

Nutrition education

Multiple approaches could be used to effectively communicate with different patients regarding the process of perioperative nutrition treatment. For example, card and display boards could be used to introduce activities such

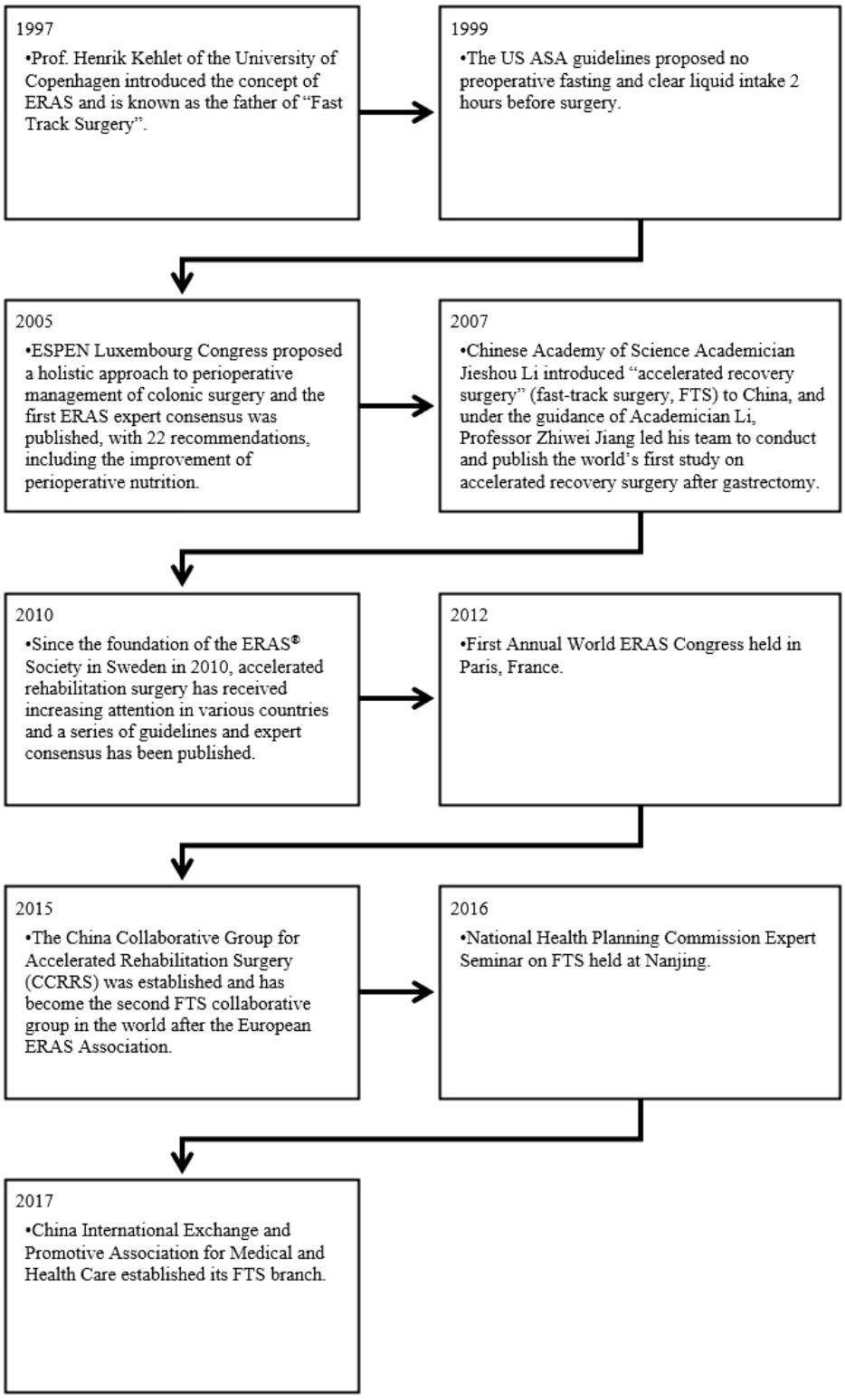

Figure 1. The emergence of Enhanced Recovery After Surgery (ERAS) and its development since it was introduced to China.

as preoperative fasting, early postoperative feeding, and early bedtime. This helps ease patient anxiety while making them aware of how important their cooperation is. Furthermore, education prior to surgery would help patient family members understand the rationale behind ERAS.

Preoperative nutrition support

Surgical evaluation phase

Nutritional assessment and preoperative nutritional support should be given when any of the following conditions occur: (1) Weight loss >10-15% within six months; (2) Body Mass Index (BMI) <18.5 kg/m^2; (3) Subjective Global Assessment (SGA) grade C or NRS 2002 score >5; or (4) serum albumin <30 g/L with no evidence of liver or renal evidence of liver and kidney dysfunction.[21] Nutritional support methods utilizing the digestive tract such as giving oral and enteral nutrition support are the first choice. However, when digestive tract nutritional support is not applicable, intravenous nutrition should be

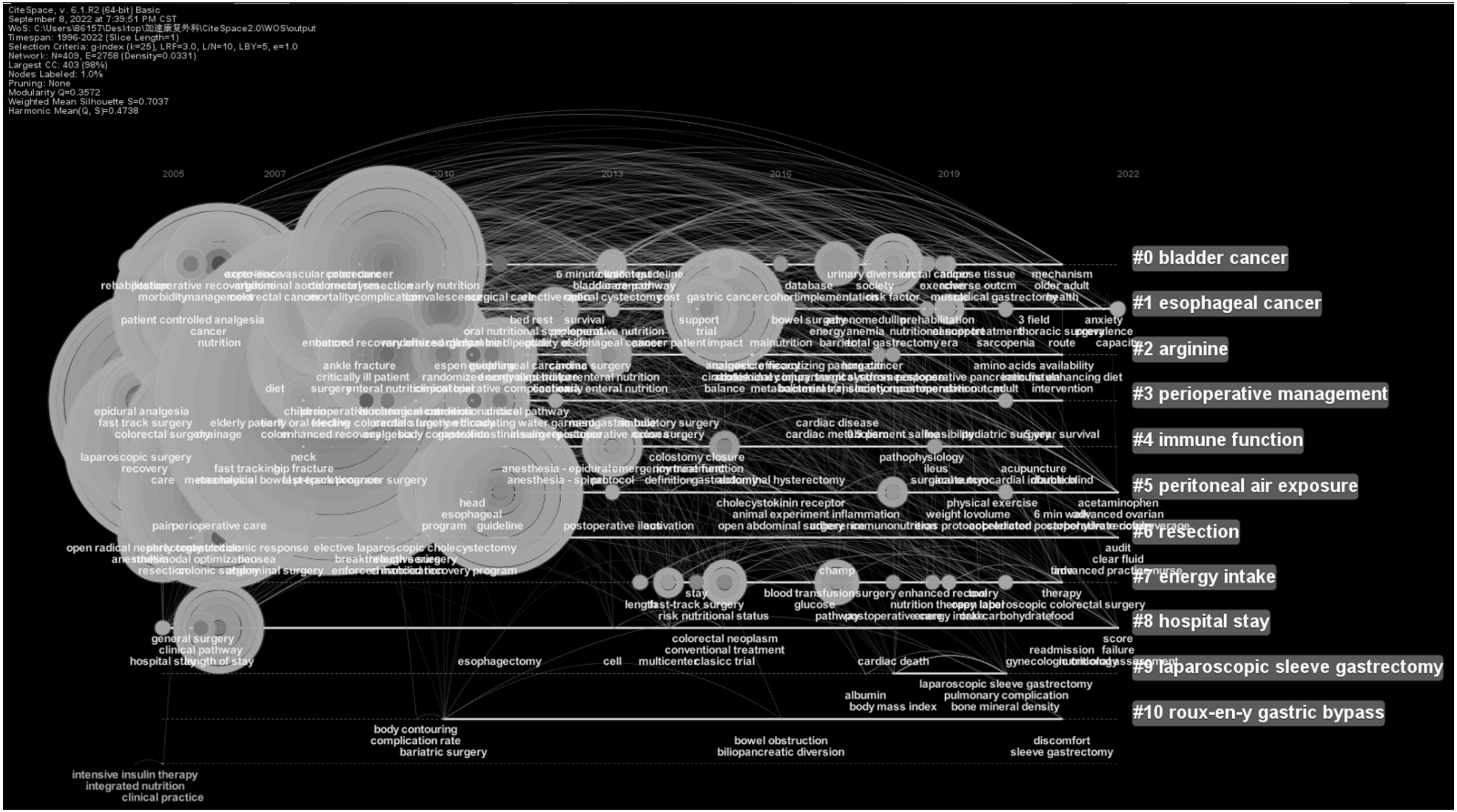

Figure 2. Keyword cluster analysis of English literature.

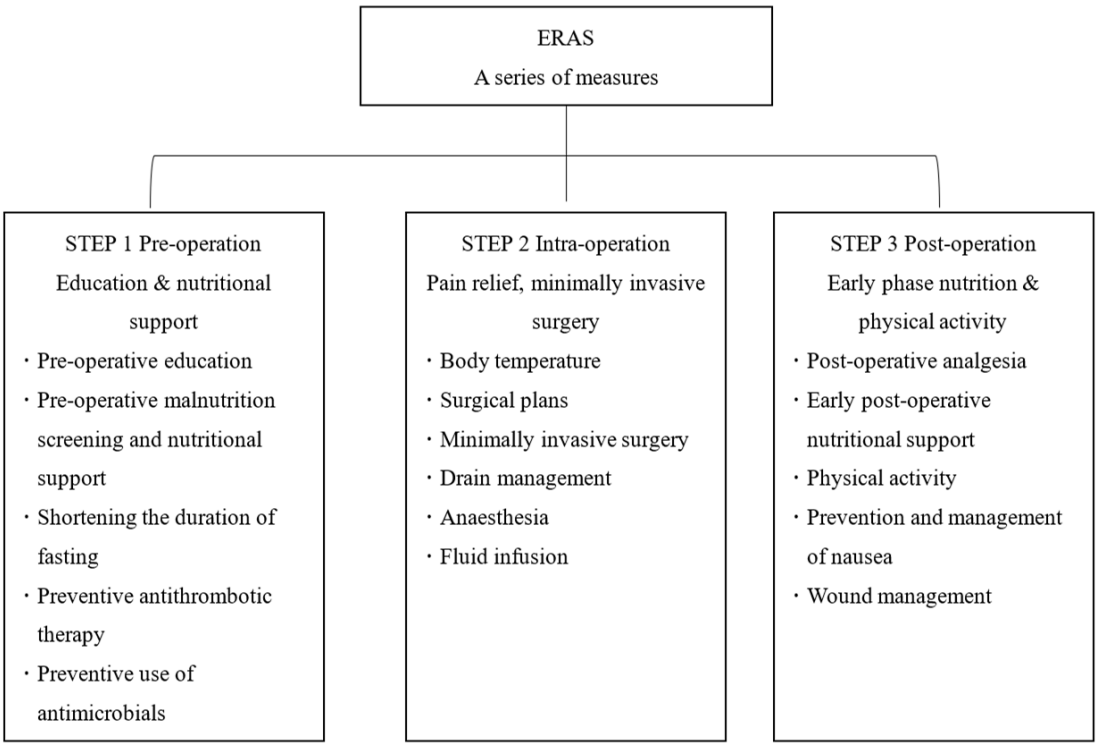

Figure 3. Nutritional support throughout surgery.

used. Preoperative nutritional support would usually last for 7 to 10 days. Patients suffering from severe nutritional issues may need longer nutritional support to improve their nutritional status and hence, reduce the incidence of postoperative complications.

Preoperative preparation phase

Prolonged preoperative fasting can lead to physiological changes including disruption of homeostasis, increased catabolism, and reduced glucose tolerance. In addition, it can impair mitochondrial function and lead to insulin resistance, resulting in increased perioperative discomfort and compliance to surgery.[22] Therefore, the preoperative fasting period should be shortened, especially clear fluid intake restrictions. Doing so would help avoid hypoglycemia and dehydration, reduce patient's hunger or thirst, and generate comfort for patients.

It is recommended that patients with delayed gastric emptying, abnormal gastrointestinal motility, diabetes mellitus, and/or emergency surgery are excluded upon screening. For eligible patients, the fasting period for starchy solid foods and dairy products is 6 hours before surgery. However, it should be noted that fried, fatty, and meaty foods require a longer fast. Clear non-alcoholic beverages including water, sugar water, fruit juices, carbonated drinks, tea, and black coffee may be consumed orally until 2 hours before surgery. The current recommendation is to give 800 mL of 12.5% carbohydrate drink and ≤ 400 mL of 12.5% carbohydrate drink 10 hours and 2 hours before surgery, respectively.

Intraoperative hydration

In intraoperative hydration, both fluid volume and sugar intake should be regulated according to the patient's intraoperative condition. Ideally, intraoperative hydration should be goal-oriented, adjusting the procedures according to specific treatment goals. For patients at different disease stages, an individualized hydration plan should be developed and implemented. Hydration is routinely achieved with certain types of common therapeutic fluids, including crystalloids, colloids, and blood products.

Crystalloids are effective in replenishing the physiological nutrient needs of the body, like electrolytes, but are less efficient in volume expansion and the duration of effect is often short. When infused in large quantities, crystalloid could also cause adverse side effects including interstitial and pulmonary oedema. On the other hand, artificial colloids have been widely used as an alternative to natural colloids for perioperative fluid and resuscitation treatment. Their strong volume expansion and long-lasting effect could help control the volume of infusion and reduce tissue oedema. For small and medium-sized elective abdominal surgery, saline-based fluids should be used as the first-line treatment. For time-consuming operations and complex surgeries with extensive bleeding, crystalloid and colloid fluids can be infused in a 3:1 ratio.[23]

Postoperative nutrition support

Postoperative nutrition support after elective abdominal surgery has been shown to promote patient recovery. For example, early resumption of oral feeding or oral supplementation enhanced intestinal motility, reduced the incidence of postoperative infection, and shortened postoperative hospital stay.[24] Once flatulence has resumed, the patient can switch from a liquid diet to a semi-liquid diet. In the meantime, intravenous nutritional support could be terminated with gradually increasing oral intake, adhering to gastrointestinal tolerance.

The timing of early feeding varies from disease to disease. For rectal or pelvic surgery, it is recommended to start eating 4 hours after surgery; for colon and gastrec-

tomy to start eating and drinking 1 day after surgery; and for pancreatic surgery to gradually resume oral diet 3 to 4 days after surgery, depending on patient tolerance. Studies have shown that early oral nutrition support (ONS) after colon cancer surgery can promote rapid recovery of bowel function and shorten the length of hospital stay.[25] In general, when oral energy intake is less than 60% of the ideal quantity, the use of oral enteral nutrition preparations should be encouraged and continued after discharge.[26] Tube feeding and parenteral nutrition are not routinely recommended in the ERAS programme. However, in cases such as co-infection, anastomotic fistula, and pancreatic fistula, parenteral nutrition should be implemented. If 60% of the recommended intake cannot be met by normal diet and oral supplementation 1 week after surgery, tube feeding should be considered; if tube feeding fails to provide 60% of the recommended intake, ancillary parenteral nutrition or total parenteral nutrition should be given.

Nutrition monitoring

To monitor nutrition status for discharged patients, a stepwise strategy is employed. Before practitioners can monitor nutrition, it is essential to check the patient's knowledge of and compliance with the clinical nutrition care process (NCP). This predicts whether the instructions would be followed and whether NCPs are changing the patient's behaviours. Information about potential reasons for non-compliance and inadequate progression could be collected at this stage. The next step is to assess the outcomes of NCPs by looking at signs and symptoms related to their nutritional diagnosis. The nutritional goals and changes in health status should also be evaluated against the overall medical diagnosis for patients. In the final step, current patient status would be compared with the pre-surgery status, which indicates on whether and how much the intervention targets have been met.

Outpatient dietary guidance and home feeding

A nutrition support team should be established to provide remote diet guidance for ERAS nutrition-managed patients. Support is delivered using social networking mobile apps through messaging or group chat. Diet guidance instructs patients on how to complete the transition of dietary styles and how to choose the type of food. Probiotics or dietary fiber supplements could be advised if the patient has difficulty in passing gas and resuming bowel movements. Currently, home parenteral nutrition support is less common in China and home feeding mainly focuses on enteral nutrition. For patients who are still malnourished at the time of discharge, continued oral enteral nutrition preparations outside the hospital with follow-up are recommended.

CONCLUSIONS

Perioperative nutritional management has evolved from simple fasting to special diets, enteral nutrition, and parenteral nutrition support focused on patient safety. Guidelines for ERAS nutritional management have now been developed in several countries including China. A number of high-quality studies have demonstrated that giving patients scientific ERAS nutritional management is safe and effective. Therefore, patients scheduled for major surgery should have a comprehensive nutritional assessment and scientific perioperative nutritional support during the preoperative, intraoperative, and postoperative rehabilitation phases. We will continue improvement and optimization of perioperative nutritional management through individualization, precision and information technology can be expected to progressively overcome the outstanding shortcomings.

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AUTHOR DISCLOSURES

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