Early Oral Nutrition

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Introduction

Three decades ago, postoperative starvation was common practice after most types of digestive surgical procedures. In particular, gastric decompression was performed until resolution of postoperative ileus [1]. This dogma was challenged with new evidence on the healing process of intestinal anastomoses, with increased collagen deposition and strength through early feeding [2, 3]. Further, a beneficial effect on wound healing was noticed [4]. A thorough first meta-analysis provided interesting new data suggesting a reduction in infectious complications, anastomotic leak rates, wound infection, and length of hospital stay, however, with an increased risk of vomiting among early fed patients [5]. Early enteral nutrition was part of the first published enhanced recovery series by Kehlet et al. of eight patients undergoing colonic resections [6]. Early feeding was combined with epidural analgesia, mobilization, and minimally invasive surgery to provide a "stress-free" surgical experience. Further studies confirmed these results, with early postoperative resumption of normal diet as an indispensable component of all early multimodal pathways [7–10].

The concept of early enteral resumption of nutrition has to be considered as part of a more global strategy, which aims to face increased metabolic demands and catabolism during surgery [11]. A comprehensive nutritional strategy needs to be launched preoperatively. Early screening for malnutrition and nutritional conditioning are mandatory (preoperative optimization). Omission of preoperative fasting—allowing a normal meal the evening before surgery and free liquids and carbohydrate loading until 2 hours prior to surgery—further contributes to decrease surgical stress. This approach allows keeping glucose levels stable by minimizing insulin resistance [12]. Early resumption of nutrition combined with stringent perioperative fluid management and early mobilization are thus a logical continuation of events. Noteworthy, several studies demonstrated a decline in postoperative nutritional status despite preoperative treatment in low- and high-risk patients, emphasizing the importance of early resumption of diet and timely launch of nutritional support if needed [13–15].

This chapter addresses the question why early enteral nutrition should be standard of care by reviewing available evidence according to type of surgery. Further, type of nutrition and criteria for nutritional supplementation in the postoperative period including enteral (tube feeding) and parenteral nutrition are reviewed.

Safety of Early Resumption of Diet

Oral nutrition including clear liquids can be initiated safely and immediately after surgery. This implies retrieval of nasogastric tubes by the end of the procedure, which has repeatedly been shown to be safe regardless of the type of surgery and even protective against pharyngeal and respiratory adverse events [16, 17]. A meta-analysis of randomized controlled trials of 2009 yielding 1173 patients did not find any drawback of early enteral nutrition [18]. Instead, a trend toward decreased postoperative medical and surgical complications and length of stay was observed. Even though the mechanism was not clear, early enteral nutrition within 24 hours was also associated with decreased mortality. The authors concluded that keeping patients "nil by mouth" is without any benefit and patients should be allowed to drink upon full recovery from anesthesia. Noteworthy, early postoperative feeding was also associated with increased vomiting [18]. A more recent randomized trial found a low residual

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O. Ljungqvist et al. (eds.), *Enhanced Recovery After Surgery*, https://doi.org/10.1007/978-3-030-33443-7_22

diet to be more efficient compared to clear fluids in preventing nausea and promoting return of bowel function after colorectal surgery [19]. However, further ileus-preventing mechanisms within an enhanced recovery pathway helped to face these drawbacks of earlier experience [20].

Evidence in Surgical Subspecialties

Colorectal Surgery

The best evidence in favor of early resumption of enteral nutrition is available for patients undergoing colorectal surgery [21]. A systematic review of 14 randomized controlled trials described early enteral feeding after elective procedures, with 12 studies reporting almost exclusively or exclusively on patients undergoing lower gastrointestinal (GI) surgery. Seven studies reported adequately on the randomization process, whereas in the remaining studies the method of randomization was either unclear or not stated at all. Studies were heterogeneous regarding inclusion criteria, feeding policies, and reported outcomes. Most outcomes failed to reach statistical significance, but mortality and length of stay were decreased in the early feeding group. A further meta-analysis of 15 studies described a significant reduction of postoperative complications in the early feeding group, with no negative impact on anastomotic dehiscence or resumption of bowel function [22]. Individual randomized trials concluded that there was no reason to withhold early oral intake, since it was well tolerated without increasing rates of postoperative ileus, providing adequate ileus-preventing measures [23, 24]. The most recent meta-analysis providing data on 7 studies and 587 patients undergoing exclusively colorectal resections confirmed these results [25]. Hospital stay and total postoperative complications were decreased, while no significant impact on anastomotic dehiscence, pneumonia, or rate of nasogastric tube reinsertion was noticed.

Also less compelling than for colorectal surgery, the concept of early enteral nutrition embedded in an enhanced recovery pathway applies also for other types of surgery [26, 27].

Upper Gastrointestinal Surgery

A landmark randomized trial by Lassen et al. including 447 patients demonstrated feasibility of normal food at will after major upper GI surgery [26]. In particular, functional recovery, major complications, and length of stay were decreased in the group, which tolerated normal food at will from the first day after surgery, as compared to the "nil by mouth" and tube feeding groups. A recent meta-analysis showed further improved cellular immunity and decreased postoperative complications in gastric cancer patients undergoing major resections [28]. The meta-analysis of Willcutts et al. came to similar conclusions [29]: Early oral feeding was associated with shorter hospital stay, while no increase in relevant complications was observed. For esophageal cancer patients undergoing esophagectomy, improved nutritional parameters at the eighth day were observed in the early oral nutrition groups, and pulmonary complications and anastomotic leaks were decreased compared to patients receiving parenteral nutrition. Further studies on esophagectomy patients confirmed safety and feasibility of early enteral nutrition, by emphasizing in particular a restorative effect on intestinal barrier function postoperatively [30]. Early oral intake as part of standardized care pathways has also been recommended and endorsed by several societies after bariatric surgery [31–33]. As a common conclusion of most studies on upper GI surgery, early feeding is feasible and safe. However, more evidence particularly in the field of esophageal surgery is warranted.

Pancreatic Surgery

In particular after pancreaticoduodenectomy, the evidence is ambiguous. Malnutrition is preponderant among patients with pancreatic cancer, and morbidity rates of up to 40% after major pancreatic surgery, including specific complications such as delayed gastric emptying (DGE), request thorough identification and timely support of patients at nutritional risk [27, 34, 35]. Early normal diet according to tolerance is safe and feasible, according to several randomized trials and systematic reviews [26, 36–38], even in the presence of delayed gastric emptying or pancreatic fistulae [27, 39]. Hence, early normal diet at will and according to tolerance should be encouraged [40]. A combined approach of early enteral nutrition with parenteral nutrition might have to be considered in some patients unable to cover their needs by the enteral route alone [41]. In this latter study, patients with a combined nutritional strategy presented with lower infectious complications, reduced rate of gastric emptying, and improved liver function compared to the comparative group receiving solely parenteral nutrition. However, a recent randomized study showed an increased postoperative complication rate including pancreatic fistulae and discouraged early enteral nutrition through a nasojejunal tube. Hence, an individual approach based on patients' nutritional status, disease presentation, and expected postoperative course should guide postoperative support strategies when normal diet at will is not sufficient.

Hepatic Surgery

In the multicenter trial of Lassen et al., 66 patients underwent liver surgery, with the aforementioned beneficial outcomes in the early nutrition group confirming its safety after major hepatic resections [26]. A randomized controlled trial by Hendry et al., combining early oral administration of nutritional supplements with administration of laxatives, accelerated bowel recovery, however, without shortening hospital stay [42]. These results of accelerated functional recovery in early fed patients were confirmed by a meta-analysis, which further demonstrated decreased infection rates and improved immune competence and concluded early enteral nutrition to be safe after liver resection [43].

Nutritional Supplementation Strategies

As discussed above, free diet should be aimed for starting from the first postoperative day. The amount of oral initial intake should be tailored to individual tolerance, since resumption of a normal everyday diet by the second postoperative day may not be an achievable goal for every patient [22, 44, 45]. Hence, energy needs might not be covered by free diet alone, since oral intake was shown to rarely exceed 1200–1500 kcal per day [46]. Oral nutritional supplements (ONS), in particular immunonutrition, may thus need to be considered to cover additional metabolic needs. According to recent European Society for Clinical Nutrition and Metabolism (ESPEN) guidelines [47], perioperative nutritional supplementation should be initiated if it is anticipated that patients are:

- Unable to eat for more than 5 days after surgery
- Unable to maintain above 50% of recommended intake for more than 7 days

Enteral nutritional support needs further strong consideration in patients at severe nutritional risk, which has been defined as follows by the ESPEN working group (2006):

- Weight loss >10–15% within 6 months
- Body mass index <18.5 kg/m^2
- Nutritional Risk Score (NRS 2002) >5
- Hypoalbuminemia (<30 g/L) with no evidence of hepatic or renal dysfunction

All parameters reflect undernutrition and disease-associated catabolism [48–50].

In all patients fulfilling the aforementioned criteria, nutritional therapy should be started independently of the type of surgery, and the enteral route should always be preferred (Fig. 22.1) [47]. Early tube feeding with standard whole protein formulas, either through a nasojejunal tube or a catheter jejunostomy for long duration, has to be considered within 24 hours of surgery in patients undergoing head and neck surgery or severely traumatized or brain injured patients [51, 52]. Several historical and more recent large-scale randomized controlled studies confirmed the superiority of the enteral route in preventing infectious complications, length of stay, and costs across all types of surgery [13, 48, 53–55]. Regarding the postoperative situation, the European and American guidelines [47, 56] recommend initiating postoperative nutritional supplementation within 24 hours. This is even more important considering that postoperative nutritional status deteriorates *despite* nutritional supplementation [15].

Postoperative Immunonutrition

The evidence regarding immune-enhanced nutrition (arginine, glutamine, omega-3 fatty acids, and nucleotides) is somewhat ambiguous [47, 57]. While a beneficial effect on postoperative outcome was repeatedly shown in patients undergoing major cancer surgery, studies differed considerably regarding regimens, control groups, and outcomes, and a recent study revealed potential industry bias [58]. Further, the optimal timing could not be defined beyond doubt [59]. As a general rule, preoperative supplementation for 5–7 days should be considered in patients at nutritional risk according to standard definitions or screening tools, i.e., Nutritional Risk Score (NRS) or Malnutrition Universal Screening Tool (MUST) [50, 60]. However, more recent evidence also supports the administration of postoperative immunonutrition [46, 59, 61, 62]. While a randomized controlled trial of Klek et al. failed to demonstrate any clear advantage of routine postoperative immunonutrition [63], two recent studies by Moya et al. showed a significant decrease of medical and surgical infectious complications [64, 65]. Because of its cost-efficiency compared to parenteral administration, enteral immunonutrition was endorsed by recent ESPEN recommendations based on the principle of no harm [47] and has to be strongly considered in malnourished patients undergoing cancer surgery [66].

Parenteral Nutritional Supplementation

The following contraindications to enteral nutritional support may warrant the use of parenteral support strategies [47]:

- Ileus
- Severe shock
- Intestinal ischemia
- High-output fistula
- Severe intestinal hemorrhage

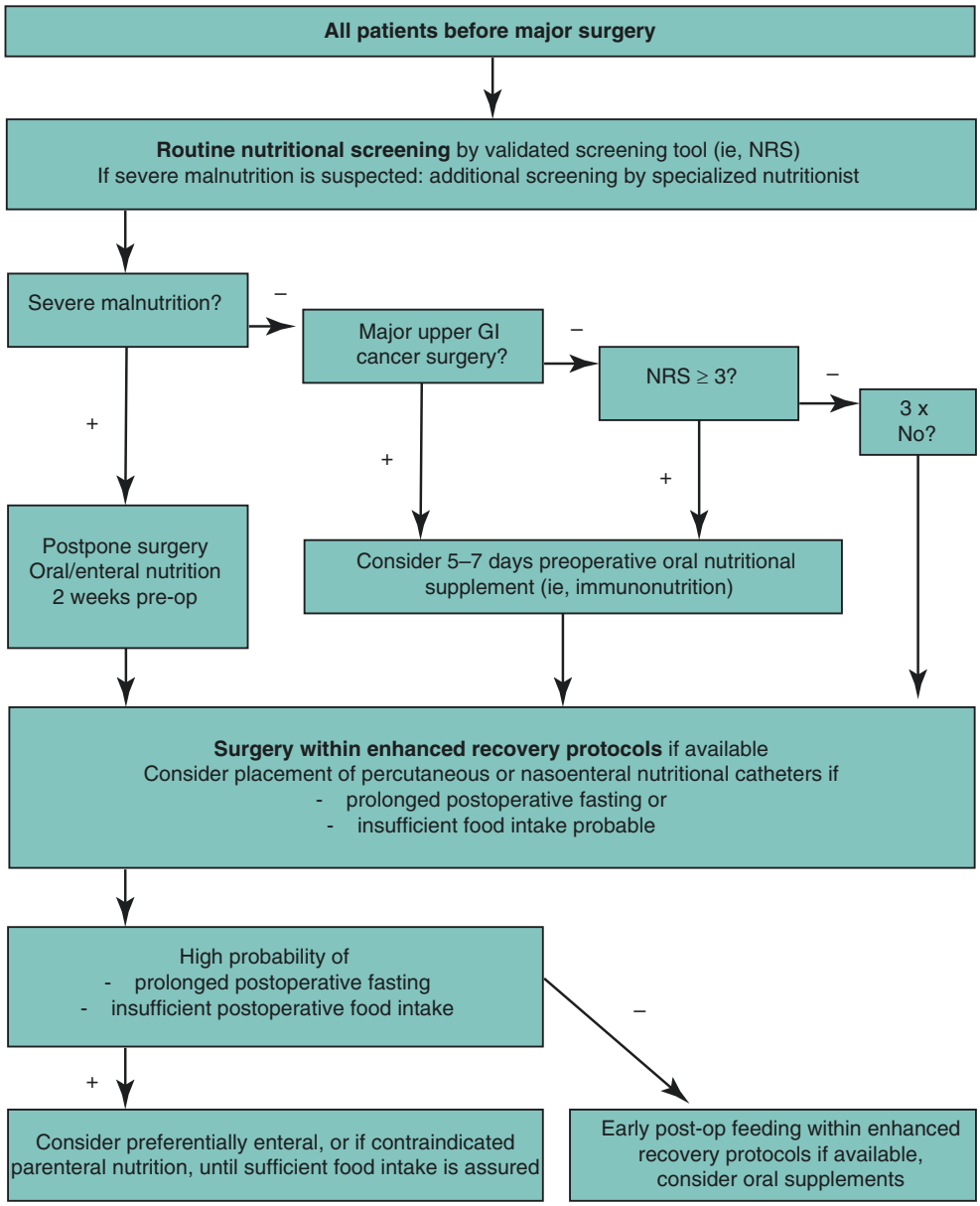

Fig. 22.1 Suggested treatment algorithm for nutritional support of surgical patients. NRS Nutritional Risk Score, GI gastrointestinal

Chen et al. presented a meta-analysis of randomized controlled trials to confirm safety and efficacy of parenteral nutrition [67]. Interestingly, an effect on leukotriene synthesis in patients with fish-oil-supplemented parenteral nutrition was observed. These findings were confirmed more recently in severely ill intensive care unit patients, especially regarding a modulated postoperative immune response [68–70].

As a common conclusion, postoperative parenteral nutrition should only be considered in patients who cannot be adequately fed enterally or who present the aforementioned contraindications [47].

Conclusion

There is overwhelming evidence to support early resumption of a normal enteral diet, which should be the standard of care after most types of surgery. Specific criteria upon nutritional screening should guide clinicians in deciding whether nutritional support is warranted, especially in malnourished and cancer patients. The enteral route should always be the first choice; however, parenteral nutrition might be indicated in some circumstances when enteral supplementation is not feasible or sufficient.

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