

Nutrition in the Surgical Patient: Historical Evolution. A Documentary Review

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Abstract

Perioperative nutrition has evolved significantly from its empirical origins into an evidence-based scientific discipline. This documentary review describes the historical evolution of nutritional strategies in surgical patients, spanning from total parenteral nutrition (TPN) to multimodal interventions such as early oral intake, oral nutritional supplements, and prehabilitation. Method: A documentary research methodology was conducted across digital platforms including PubMed, Google Scholar, and Semantic Scholar, utilizing terms related to nutrition and its historical evolution. The search keywords were: preoperative nutrition, postoperative nutrition, surgical patient, history of nutrition, nutrients, vitamins, lipids, fatty acids, and proteins. Discussion: The findings indicate that modern nutritional interventions improve gastrointestinal recovery, reduce postoperative complications, and shorten hospital stay, although evidence regarding long-term survival remains limited. Conclusion: The paradigm of nutrition has shifted from a reactive intervention against malnutrition to a proactive, central pillar in the optimization of surgical outcomes, offering recommendations backed by robust evidence and tailored to the individual characteristics of each patient.

Kew Words: preoperative nutrition; postoperative nutrition; surgical patient; history of nutrition; nutrients; vitamins; lipids; fatty acids; and proteins

Introduction

Nutrition in the surgical patient has evolved from a peripheral concern to a central component of perioperative planning. From early intravenous feeding attempts in the 20th century to current personalized nutritional support strategies, this evolution has been driven by advancements in physiology, medical technology, and clinical evidence. This review aimed to describe the historical evolution of nutritional strategies in surgical patients—ranging from total parenteral nutrition (TPN) to multimodal interventions such as early oral intake, oral nutritional supplements, and prehabilitation—in order to elucidate the role of nutritional interventions in the surgical patient throughout the years.

Method

A documentary research methodology was conducted across the digital platforms PubMed, Google Scholar, and Semantic Scholar, utilizing specific terminology related to nutrition and its historical evolution.

Discussion and Development

History of Surgical Nutrition

The history of surgical nutrition has progressed since antiquity—transitioning from rudimentary practices such as nutrient enemas—toward modern, scientifically grounded approaches. Today, the strategy is multidisciplinary, incorporating preoperative nutrition to optimize the patient's condition and postoperative nutrition to facilitate recovery and minimize complications. This evolution has encompassed the development of enteral nutrition (tube feeding) and parenteral nutrition (intravenous feeding), alongside the recognition of nutritional status as a critical determinant for prognosis, wound healing, and reduced hospital length of stay (1).

Feeding Modalities

Rectal Administration

More than 3,500 years ago, specifically in Ancient Egypt, information preserved in papyri reveals that enemas were utilized in various patients to administer nutrients rectally, serving as an entry point to the gastrointestinal tract. Rudimentary devices—generally non-flexible tubes—were employed, rendering rectal access an effective route to the digestive tract. This approach was considered more feasible and secure than oropharyngeal or nasopharyngeal access. This rectal route, utilized via syringes or direct rectal instillation, was deemed an effective method for administering concentrated nutrients to preserve health through alimentation. This nutritional pathway was adopted first by the Egyptian civilization, subsequently by the Greek civilization, and remained in use until the 17th century (2).

Oropharyngeal Access

Although isolated records documenting orogastric or oropharyngeal feeding date back to the 12th century, it was in 1598 when a nutrient mixture was first introduced into the esophagus via the oropharynx, specifically utilizing a hollow tube attached to a bladder (2).

Gastric Feeding

John Hunter—a renowned Scottish surgeon and anatomist who practiced in London at St. George's Hospital, later serving as surgeon extraordinary to the King of England and working with the British Army—was the first to administer food directly into the stomach in 1793. He utilized a hollow catheter (specifically a whalebone covered with eel skin) connected to a syringe. The nutrients consisted of mixtures of gelatin, eggs, sugar, milk, and wine. Hunter successfully utilized this technique to treat a patient presenting with neurological dysphagia secondary to paralysis of the deglutition muscles (3).

Intestinal Access

In 1910, Max Einhorn became the first to substitute rectal feeding with duodenal administration when the gastric route was inaccessible or unusable. To achieve this, he designed a ultra-fine tube equipped with a metallic distal tip, which facilitated its passage from the stomach into the duodenum by overcoming gastric peristaltic waves. He administered liquid diets composed of cow's milk, raw eggs, and lactose at a highly controlled, slow infusion rate (4).

Another modality of intestinal feeding is the jejunostomy, defined as the creation of direct access to the jejunum for enteral nutrition. Its development cannot be attributed to a single author within modern medical literature; rather, it has been a progressive development involving multiple surgical techniques described and refined over time by various investigators and surgical groups. Currently, surgical, endoscopic, and radiological variants exist, each incorporating relevant technical modifications driven by technological evolution and clinical demands (5).

Evolution of the Nutritional Approach

Over recent decades, the role of nutritional optimization has been extensively studied as a promising and practical perioperative intervention to mitigate complications and improve outcomes in surgical patients.

Preoperative Nutrition

Nutritional objectives within contemporary preoperative practice focus on optimizing surgical preparation to minimize fasting periods, prevent postoperative malnutrition, and promote anabolism to enhance recovery.

Preoperative parenteral nutrition is indicated in malnourished surgical patients who cannot achieve adequate nutrient intake via oral or enteral

routes (5). The indication for preoperative parenteral nutritional support is directed toward ensuring adequate energy and protein substrate delivery; patients should receive this therapy for at least seven days prior to surgery.

The primary objective of preoperative parenteral nutrition is not weight restoration, but rather the replenishment of energy reserves, proteins, micronutrients, and glycogen storage. Complications associated with preoperative parenteral nutrition are infrequent (6). It is categorized into two major modalities: Total Parenteral Nutrition (TPN) and Peripheral Parenteral Nutrition (PPN).

Total Parenteral Nutrition (TPN)

Modern total parenteral nutrition (TPN) was pioneered primarily by surgeon Stanley J. Dudrick and his team at the University of Pennsylvania in the 1960s. Alongside Douglas Wilmore, he achieved complete intravenous feeding in patients for the first time, enabling the growth and development of an infant with near-total intestinal atresia, and subsequently applying the technique to adults with intestinal failure. The modern era of clinical nutrition began with Dudrick's development of total parenteral nutrition (7), demonstrating for the first time that clinicians could successfully manage intestinal failure with the capacity to deliver nutrients to any hospitalized patient.

Peripheral Parenteral Nutrition (PPN)

Peripheral parenteral nutrition (PPN) is an intravenous nutritional support modality that utilizes peripheral veins for nutrient administration, in contrast to TPN, which necessitates central venous access (7). The development of PPN is not credited to a single individual but represents a technical evolution derived from 20th-century advancements in the intravenous administration of glucose, electrolyte, and amino acid solutions. Researchers such as Robert Elman demonstrated in the 1930s that protein hydrolysates could be safely administered intravenously, laying the foundation for formulating solutions with reduced osmolality suitable for peripheral infusion (13).

Postoperative Nutrition

The history of postoperative nutrition reflects a significant evolution in the management and understanding of nutritional support in surgical candidates. The initial recognition of the correlation between malnutrition and postoperative mortality led to the development of strategies to optimize nutritional status before and after surgery, particularly following demonstrations that preoperative weight loss directly increased surgical mortality (9).

In recent years, integrating nutrition into multimodal Enhanced Recovery After Surgery (ERAS) protocols has transformed the perioperative approach. This paradigm prioritizes systematic nutritional assessment, reduction of preoperative fasting times, early oral feeding, and individualized supplementation tailored to nutritional risk (10).

ERAS Protocol

Originating in the 1990s primarily within the field of colorectal surgery, the Enhanced Recovery After Surgery (ERAS) protocol was developed by the ERAS study group led by Olle Ljungqvist and colleagues. It comprises a framework of evidence-based, perioperative multimodal strategies designed to attenuate surgical stress and promote organ function recovery. Since its inception, it has been adopted and adapted across multiple surgical subspecialties—including gynecological, cardiac, bariatric, orthopedic, and trauma surgery—with the endorsement of international bodies such as the ERAS Society and the Society of Thoracic Surgeons (11).

It is established as a multimodal and multidisciplinary approach to perioperative care, designed to optimize the recovery of patients undergoing

major surgery. This is achieved by implementing interventions based on the best available evidence throughout the entire surgical continuum, from the preoperative phase to the immediate postoperative period. The primary objective is to reduce complications, accelerate the return to baseline functional status, and decrease hospital length of stay, without increasing readmission rates or compromising patient safety (9).

Furthermore, novel strategies such as immunonutrition and the assessment of sarcopenia through advanced imaging techniques have been incorporated, reflecting a growing sophistication in the personalization of nutritional support.

Immunonutrition

Nutritional immunology is a recently recognized subdiscipline of profound clinical and public health relevance. Its history began in 1810 with the identification of lymphoid tissue atrophy resulting from malnutrition. The discovery of vitamins in the early 20th century was subsequently followed by reports regarding their contribution to immunity and host defense mechanisms (14).

The concept of immunonutrition within clinical and medical nutrition is not attributed to a single pioneer; instead, it emerged from the evolution of nutritional immunology and the integration of data showing how specific nutrients modulate the immune response. Immunonutrition is a science that encompasses aspects related to nutrition, immunity, infection, inflammation, and tissue injury. Immunomodulatory formulas have demonstrated clear benefits across a wide spectrum of clinical scenarios (8).

It has been shown to reduce postoperative fistulas in patients with head and neck cancer. In patients with gastric and esophageal cancer, it is associated with a decrease in infectious complications and hospital stay (8). Other clinical scenarios that benefit from the use of immunonutrition include pancreatic cancer surgery, colorectal cancer surgery, and burn management (8).

Currently, international guidelines recommend the early reintroduction of oral intake, supplementation with oral nutritional formulas in high-risk patients, and reserving artificial nutrition (enteral or parenteral) exclusively for cases where nutritional requirements cannot be met via the oral route.

Conclusions

- The paradigm of nutrition has shifted from a reactive intervention against malnutrition to a proactive, central pillar in the optimization of surgical outcomes, offering recommendations backed by robust evidence and tailored to the individual characteristics of each patient.
- Modern nutritional strategies—such as early oral intake, immunonutrition, and the ERAS protocol—have been proven to reduce postoperative complications and enhance functional recovery, thereby minimizing hospital stay.
- Nutrition is currently tailored to the individual characteristics of the patient, which optimizes surgical outcomes.
- Although significant progress has been achieved over the years regarding access to and optimization of medical nutrition therapy, evidence concerning its impact on long-term survival remains limited.

Administrative Disclosures

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