SURGICAL NUTRITION

An Essay

Submitted for partial fulfillment of Master degree in General Surgery

By

AYMAN EL SAYED AMER

(M.B., B.ch.)

Supervised By

Prof. Dr. MOHAMMED SAED KAMEL

Prof. of General Surgery

Faculty of medicine, Ain Shams University

Dr.Ahmed Abdel khalek Ahmed

Assist. Consultant. of General Surgery

Faculty of medicine, Ain Shams University

"Faculty of medicine, Ain Shams University"

2011

التغذية الجراحية

رسالة

توطئة للحصول على درجة الماجستير
في الجراحة العامة

مقدمة من
الطبيب/أيمن السيد عامر
بكالوريوس الطب والجراحة

تحت إشراف

ا.د /محمد سعيد كامل
أستاذ الجراحة العامة
كليّة الطبِّ
جامعة عين شمس

د / أحمد عبد الخالق أحمد
استشارى مساعد الجراحةِ العامّةِ
كليّة الطبِّ
جامعة عين شمس

كليّة الطبِّ
جامعة عين شمس
٢٠١١

Contents

Contents

List of figures

LIST OF TABLES

INTRODUCTION

Surgical nutrition is a basic nutritional knowledge that should be an integral part of the educational background of all junior and senior surgeons involved in the management of complex diseases ***(Gibney et al., 2005).***

The importance of surgical (especially parenteral) nutrition can be understood by realizing the drama of some clinical circumstances in which oral or even enteral feeding seems to be impossible before artificial nutrition became available ***(Stroud et al., 2003).***

Clinical assessment of nutritional status should be included in the history and physical examination of every surgical patient. The presence or absence of anorexia, nausea, and vomiting and chronic or recent weight loss should be documented in every case. Serum levels of albumin, prealbumin, and retinol-binding protein are used as indices of protein synthesis. Both retinol-binding protein and prealbumin are more sensitive markers for nutritional deficits of recent onset, since the half-lives of these proteins are much shorter than the half-life of albumin. So Reduced levels of these proteins in the blood represent an indication for nutritional support ***(*****Secker and Jeejeebhoy**, ***2007)***.

A major controversy in the field of nutrition support concerns the relative indications for the use of parenteral nutrition versus enteral nutrition. Proposed advantages of enteral nutrition include reduced cost, better maintenance of gut integrity, reduced infection, and decreased hospital length of stay ***(Lipman, 2002).***

Developments in feeding tube manufacture and enteral access procedures, particularly in techniques that enable intestinal placement of feeding tubes, have resulted in exponential growth of enteral nutrition over the past decade. This technique is now used to support and restore intestinal function in surgically hospitalized patients who are unable to eat. Sufficient knowledge of the physiology of the upper gastrointestinal tract and how it reacts to severe illness and to various diet formulations is a must for enteral nutrition ***(Nguyen*** **et al., 2007).**

Many patients can tolerate short periods of starvation after severe stress however, prolonged starvation impairs organ function, predisposing to infection, increases morbidity, and can result in death. Optimal timing of nutritional support and proper choice of an appropriate and safe route should be considered (***Pamela, 2003).***

Description of the main nutritional problems of the most common diseases that surgeons face in the everyday practice such as mesenteric infarction, acute pancreatitis, short bowel syndrome, or enterocutaneous fistulas is emphasized, as well as the recognition of severe malnutrition and the meaning of hypoalbuminemia in the preoperative setting. Finally, the most relevant complications of parenteral nutrition support have been updated with a special accent put on its septic complication.

The nutritional status of patients is an important determinant of outcome after surgery and there is a strong association between malnutrition and poor clinical outcome. That's because malnutrition disturbs cellular and organ function resulting in impaired cardiac and respiratory muscle function, atrophy of smooth muscle in the gastrointestinal tract, impaired immune function and impaired healing of wounds and anastomoses. These changes not only impair recovery after surgery but are associated with complications for example (anastomoses leak, wound infections and pressure sores) and increasing healthcare costs (prolonged hospital stays, recurrent hospital admissions and primary care visits) **(Stratton and Elia,*2007*)**.

AIM OF THE WORK

To clarify the role of surgical nutrition with accurate assessment of nutritional status of surgical patients in enhancement of outcome of surgical procedures, reducing complications and mortality among the surgical patients which requires more attention and better understanding by the treating surgeons.

Historical review

In order to start reviewing the history of Enteral Nutrition, we are forced to recall rectal feeding, since the Egyptians, approximately 3,500 years ago, were the first to begin with that technique. Rectal alimentation with food enemas as a way of health preservation was recorded on some papyri. They contain a description of how they administered through the rectum, probably using pressure on a pipette tied to a bladder, a wide variety of foods such as milk, whey, malted cereals, wine, etc **(McCamish et al., 2007).**

More recently, rectal administration was used during World War II for administering water, saline solutions, glucose, amino acids in isotonic solution and some medication. However, probably the most known case of such nutritional enemas, due to its historical repercussions, was that of US President James Garfield who was kept alive for 79 days in 1881 by four-hourly feeds providing beef peptones, defibrinated blood and whisky, until his death (**Stanley and Dudrick**, **2009).**

Throughout the history of mankind, Medicine has advanced more in the last 50 years than in all the previous centuries taken together. Technological advances, the huge developments in scientific research and the new demands of society have allowed Modern Medicine to emerge as a group of disciplines at the service of modern mankind. Surgical Nutrition is one of the most developed disciplines forming part of this Modern Medicine. Within surgical nutrition, Enteral Nutrition (EN) is probably the discipline that has generated the greatest changes **(Hernandez et al., 2006)**.

In 1617, Fabricius Aquapendente used silver tubes inserted nasopharyngeally to feed children with lockjaw. These rigid tubes were subsequently replaced by flexible leather tubes made by Von Helmont. One century later, John Hunter (1793) fed a patient with dysphagia due to paralysis of the swallowing muscles using a whale bone tube covered with eel skin and connected to a kind of bladder that operated like an infusion pump. By means of this mechanism, he was able to administer the patient jams and other sugary syrups, raw eggs, milk, wine and also the suitable medication. This procedure allowed this nasogastric access route to be reaffirmed as safe and effective method of enteral nutrition **(Hunter, 1793).**

It is worth mentioning the efforts of various surgeons for designing techniques that allowed safe digestive entryways like gastrostomy, jejunostomy, etc., to be obtained in the first half of the 20th century or the use of dual lumen catheters allowing the infusion of an enteral formula through one duct and the extraction of the stomach's contents through the other **(Harkness and Laura, 2002)**.

The real advance in enteral nutrition has come in the last 20 years. Only recently has the mention of such concepts as medical food, with the administrative and legal consequences of this terminology, begun to be used. Finally, we cannot but recall the historical milestone that allowed us to bring this technique closer to the common citizen. We are referring to the fundamental role played by the possibility of feeding the three astronauts who stepped onto the moon in 1969 in the development of the first enteral formulations. Armstrong and Aldrin Collins were fed during their space journey with an elemental or chemically defined diet. Even today, recalling this event makes it much easier for patients to understand the contents and significance of EN formulations **(Nism and Allins, 2005).**

In the beginning of the 20th century, it was known that dietary proteins were hydrolyzed in the intestinal tract before absorption occurred. It was then logical to investigate the effect of IV administration of amino acids and hydrolysates. The first successful study in this field was reported in 1913 by the 2 Danes, Henriques and Andersen (1913), who infused a beef hydrolysate into a goat and achieved a positive nitrogen balance. At the same time, Van Slyke and Meyer (1913) reported their studies on the metabolism of amino acids obtained from the hydrolysis of casein or beef protein infused into dogs (**Henriques et., al 1913**).

The first to introduce a crystalline L-amino acid solution was Bansi in 1964 in Germany. In the early development of crystalline amino acid solutions, it was difficult to include tyrosine, cysteine-cystine, and glutamine because of technical reasons. Earlier it was believed that glutamine was an indispensable amino acid. However, the study by Bergstrom et al., (1974) showed that glutamine was the most abundant intracellular free amino acid in skeletal muscle, and in 1976, the same group demonstrated that after trauma or operations, the glutamine content in muscle tissue dropped approximately 50%.The significance of these findings was unclear at this time, but glutamine could not be included in balanced amino acid solutions because of its low solubility and lack of a stable shelf life. These problems were solved by Furst et al in the 1980s by introducing dipeptides, which enhanced solubility and stability and made it possible to develop solutions containing both glutamine and tyrosine. The only existing problem with the amino acid solutions used today is to supply cysteine-cystine, which is unstable even as dipeptide if the solutions undergo heat sterilization (**Furst et al., 1990**).

Christopher Wern (1939)has been often referred to as the first to make a rational approach to intravenous feeding when he reported in the seventeenth century how to access the venous system using the hollow shaft of a goose quill attached to a pig bladder serving as an infusion reservoir. He used his system to infuse several raw nutrients such as beer or wine. Follow-up of the patients, however, was not reported! Thereafter, several anecdotal pioneering reports can be found including intravenous infusion of saline and milk for cholera by Latta (1831) in Scotland and glucose infusion by Claude Bernard (1859) Discovery of vitamins and trace elements, and the improvements in the techniques of protein hydrolisation led to the first well founded reports of parenteral nutrition around the World War II years by Elman (1937) ***(Pearce and* Duncan*, 2002).***

NUTRITIONAL REQUIREMENTS

1- Energy Requirements

The energy and protein requirement of the surgical patient who cannot eat is different from the amount required to maintain the nutrient status in normal subjects and ambulatory patients. Total energy requirements should be met to promote nitrogen balance, while in the immediate postoperative period, underfeeding is accepted for a short time, since nitrogen balance can never be met during the stress response. In addition, the ability to metabolize carbohydrate and fat is decreased during the stress response; the main target in this period is to improve organ and immune function and to promote wound healing while at the same time avoiding complications of nutrition support, such as hyperglycemia. Once patients recover from the stress of surgery and any associated complications, energy requirements can be increased to full goal. The suggestions below for energy and protein requirements are target amounts for surgical patients and should be adjusted according to substrate tolerance and the response to therapy as measured by visceral proteins, weight gain, wound healing, and functional status ***(Douglas and Seidner, 2006).***

Protein needs cannot be determined solely from factorial and nitrogen balance data, but require amino acid turnover data and, ideally, data on metabolic and functional status to reflect protein's roles. The current recommendations for protein are based predominantly on nitrogen balance data, but not on optimal metabolic balance or metabolic function. More recent data support levels of about 186 mg/kg per day of essential amino acids to make up 25% to 30% of protein intake **(Young and Borgonha, 2009).**

The energy requirements of most surgical patients can be met by providing 25-30 kcal/kg/day in an optimal ratio of 70% carbohydrate calories to 30% fat calories. Specific surgical conditions may require modifications of these requirements. Burn patient as an example, require as much as 40-45 kcal/kg/day in order to meet greatly increasing metabolic requirements. carbohydrate administration should not exceed 4 mg/kg/min. Carbohydrate administered more than this rate is not oxidized, but stored as lipid resulting in hepatic steatosis as well as the other complications associated with carbohydrate overfeeding. Optimal nutritional support may be possible by delivering as little as 80% of a patient's calculated energy requirements **(Gibney et al., 2006).**

Methods to Estimate Energy Expenditure

(A)-Harris-Benedict equation:

The Harris-Benedict equation is the most commonly used method of estimating metabolic energy requirements. It calculates the estimated basal energy expenditure (BEE) in kcal/day for a patient using the following equations:

Male: BEE = 6.6 + [(13.7) x (weight in kg)] + [(5) x (height in cm)] - [(6.8) (age)]

Female: BEE = 6.65 + [(9.6) x (weight in kg)] + [(1.8) x (height in cm)] – [(4.7) x (age)]

1-Basal energy expenditure (BEE)

Refers to energy expended in 24 hr to maintain life processes at complete rest, after a 12 hr fast in a thermo neutral environment. For practical reasons, BEE is now rarely measured. Resting energy expenditure (REE) refers to energy expended over 24 hr at rest under conditions other than strictly basal. Since the REE is only 5-10% > than BEE, the same equations to estimate BEE can be used to estimate REE **(Barak, 2002).**