Nutritional Deficiency Following Bariatric Surgery

An Essay
Submitted for Partial Fulfillment of Master Degree in General Surgery

By

Khaled Mohammed Abd-Elbar
M.B., B.Ch., General Surgery

Supervised By

Prof. Dr/ Fateen Abd Elmoneim Anos
Professor of General Surgery
Faculty of Medicine - Ain Shams University

Dr/ Karem Sabry Abdelsamee
Lecturer of General Surgery
Faculty of Medicine -Ain Shams University

Faculty of Medicine
Ain Shams University
2017

نقص التغذية التى تتبع عمليات جراحات السمنة

رسالة

توطئة للحصول على درجة الماجستير فى الجراحة العامة

مقدمة من

الطبيب/ خالد محمد عبد البر

بكالوريس الطب والجراحه

تحت اشراف

ا.د/ فطين عبدالمنعم عانوس

استاذ الجراحة العامة

كلية الطب البشرى

جامعة عين شمس

د/ كريم صبرى عبدالسميع

مدرس الجراحة العامة

كلية الطب البشرى

جامعة عين شمس

كلية الطب

جامعة عين شمس

٢٠١٧

First of all, all gratitude is due to ALLA almighty for blessing this work, until it has reached its end, as a part of his generous help, throughout my life.

I would like to express my sincere appreciation and deepest thanks to my supervisor, Prof. Dr/ Fateen Abd El Moneim Anos, Professor of General Surgery, Faculty of Medicine - Ain Shams University, for his guidance, encouragement, suggestion and very constructive criticism which have contributed immensely to evolution of this work.

I would also like to express my deepest thanks to my supervisor Dr. Karem Sabry Abd Elsamee, Lecturer of General Surgery, Faculty of Medicine -Ain Shams University, for her valuable guidance, keen interest and encouragement at various stages of the study.

Thanks for my all Professors and colleagues help me even by advice.

Khaled Mohammed Abdel-Bar

To My Father, My Mother and Sister

To My Lovely Wife, My Sweet Girls

INTRODUCTION

Obesity is the excessive accumulation of adipose tissue to an extent that health is impaired; it becomes one of the major risks to health affecting the world's population. Obesity is a complex disease for which no single cause or cure exists. You gain weight when you take in more calories than you burn off. But obesity is influenced by many other factors as well: sedentary life, genetics, medical illness and many hormonal mechanisms have been elucidated that participate in the regulation of appetite and food intake, storage patterns of adipose tissue and development of insulin resistance e.g. leptin and ghrelin. **(1)**

The most widely accepted measure of obesity is the body mass index (BMI) which equals patient weight in kilograms divided by the square of his or her height in meters, a normal BMI ranges from 18.5-24.9 kg/m^2, overweight equals BMI between 25-29.9 kg/m^2, obesity equals BMI 30 kg/m^2 or higher. **(2)**

Severe obesity is having a BMI greater than 35 kg/m^2, and morbid obesity is having a BMI greater than 40 kg/m^2 or a BMI greater than 35 kg/m^2 with concomitant obesity-related morbidity.**(3)**

Obesity is associated with increased morbidity and mortality. Morbidity appears with hypertension, lipid disturbances, non-alcoholic steatohepatitis, obstructive sleep apnea and polycystic ovary syndrome, insulin resistance, and

diabetes. These co morbidities are responsible for more than 2.5 million deaths per year worldwide.[4]

Treatment possibilities of obesity include diet restriction, behavioral therapy, medical treatment, and surgery. All non surgical treatment regimens have an extremely high rate of failure and surgery is therefore today is the option of choice for treatment of morbid obesity.[5]

Bariatric surgical procedures are categorized into 2 main types; restrictive and malabsorptive. Some operations combine both restriction and malabsorption. The operations that are most frequently performed are sleeve gastrectomy, the Roux-en-Y gastric bypass, vertical banded gastroplasty, biliopancreatic diversion, and various banding procedures.[6]

As more bariatric operations are performed, the potential increases for more patients to present with nutrient abnormalities. Therefore, health care practitioners must learn to recognize and treat the nutritional consequences of weight-loss operations as well as know how to screen for and prevent deficiencies. that can lead to metabolic bone disease, neuro logic abnormalities and protein malnutrition.Some of these deficiencies can develop rapidly after surgery, and most worsen with time as body stores of nutrients and vitamins are depleted within 1 year of surgery.[7]

Surgical weight loss Patients are vulnerable to malabsorption of iron, B vitamins, calcium, folic acid, and vitamin A, Fat malabsorption may predispose patients to

deficiencies of vitamins A, D, E and K. Unexplained anaemia, poor wound healing, hair loss, neutropaenia, peripheral neuropathy or cardiomyopathy may be symptoms of zinc, copper or selenium deficiency .Protein malnutrition is commonly precipitated by complications such as stricture, excessive vomiting. [8]

A well balanced, calorie-reduced diet, vitamins , minerals supplementation and continued nutritional monitoring is essential to ensure that patients do not develop nutritional problems in the longer term .Caring for patients who undergo weightloss surgery presents a challenge for health care professionals. [9]

AIM OF THE WORK

This study aims to shed some light on the nutritional consequences of bariatric surgery and how to screen for and prevent deficiencies.

Chapter (1):

PATHOPHYSIOLOGY OF OBESITY

Definition and Classifications of Obesity:

Obesity can be defined as a disease in which excess fat has accumulated, such that health may be adversely affected and mortality is increased[(10)].

Obesity is a medical condition in which excess body fat has accumulated to the extent that it may cause numerous and serious chronic and fatal diseases. When exposed to overnutrition, humans are susceptible to develop diabetes, hypertension, cardio-pulmonary failure and various malignant neoplasms, all of which contribute to diminished life span[(11)].

Obesity is a state of excess adipose tissue mass. Although often viewed as equivalent to increased body weight, this need not be the case-lean but very muscular individuals may be overweight by numerical standards without having increased adiposity. Body weights are distributed continuously in populations, so that choice of a medically meaningful distinction between lean and obese is somewhat arbitrary. Obesity is therefore more effectively defined by assessing its linkage to morbidity or mortality [(12)].

Obesity is quantified by body mass index (BMI) which is weight in kilograms divided by height in meters squared (kg/m^2). Obesity is classified according to BMI to 5 categories (as in table 1) [(13)].

BMI = Weight (Kg) / height $(m)^2$

Table (1): Classification of obesity class according to BMI.[13]

Severity	BMI
Overweight	25.0 – 29.9 kg/m^2
Obesity (class 1)	30.0 –34.9 kg/m^2
Moderate obesity (class 2)	35.0 – 39.9 kg/m^2
Morbid obesity (class 3)	40.0 – 49.9 kg/m^2
Super morbid obesity	>50 kg/m^2

However, the definition of overweight and obesity varies by race. In some populations, the level of risk in terms of percent body fat is reached at a much lower BMI (South Asians), and in others, a higher BMI (blacks), compared to whites. This was illustrated in a study comparing South Asian and European subjects. The mean BMI associated with development of an adverse metabolic profile (defined by markers of glucose and lipid metabolism) was 21 and 30 kg/m^2 in South Asians and Europeans, respectively [14].

It may be important to consider other factors besides the BMI, such as total muscle mass and waist circumference as extremely muscular individual may have an elevated BMI without being overweight, Waist circumference has been shown to be an excellent indicator of abdominal fat mass, a circumference greater than 88 cm (35 inch) in women or 102 cm (40 inch) in men

strongly correlates with an increased risk of obesity related disease [15].

Obesity is the most common form of malnutrition in developed countries, prevalence of obesity is rising to an epidemic proportion around the world [16].

Obesity is a major health problem worldwide and has reached an epidemic proportion in the western society. Evidence continues to accumulate that obesity is a major risk factor for many diseases and is associated with significant morbidity and mortality [17].

Obesity accounts for 2-6% of total health care costs in several developed countries; some estimates put the figure as high as 7%. The true costs are undoubtedly much greater as not all obesity-related conditions are included in the calculations, often coexisting in developing countries with under-nutrition, obesity is a complex condition with serious social and psychological dimensions, and the rising epidemic reflects the profound changes in society and in behavioral patterns of communities over recent decades [18].

Causes and Risk Factors of Obesity

Any small disparity between energy intake and energy expenditure gradually leads to weight gain. A continued excess of energy intake over energy expenditure gradually leads to obesity[19].

The following are known causes of obesity:

1- Diet:

Dietary changes over the past 30 to 40 years have led to proliferation of energy-dense foods rich in fat and sugar, particularly carbonated beverages. Foods high in fat do not produce satiety as well as foods rich in carbohydrate. This leads to overconsumption of food [19]. Frequent fast-food consumption may also be associated with weight gain and risk of type 2 diabetes [20].

Obesity may result from consumption of large amounts of food as in cases of binge eating disorder. Binge eating disorder is characterized by the consumption of an objectively large quantity of food in a brief period (less than 2 hours), during which the individual experiences a subjective loss control. Overeating episodes are not followed by purging, which distinguishes this disorder from bulimia nervosa [21].

2- Lifestyle:

Low levels of physical activity, even if caloric intake is within normal limits, may not affect intake. Use of labor-saving devices, preferences of riding in a car instead of walking, and increases in passive forms of leisure (eg, television, computers) have led to an obesity-prone population [22].

Obesity is more prevalent in adults with physical, sensory, or mental health disabilities. Those with impaired lower extremity mobility are at highest risk [23].

The proportion of adults in the United States sleeping less than seven hours per night has increased from 16 to 37 percent over the past 40 years, a lifestyle change that may have negative metabolic consequences. This was illustrated in a study of 12 healthy, normal weight, adult men who underwent two nights of sleep restriction (four hours per night) and two nights of sleep extension (10 hours per night) in a randomized order, spaced six weeks apart with controlled conditions of caloric intake and physical activity. Sleep restriction, when compared to sleep extension, was associated with a decrease in serum leptin (an anorexigenic hormone), an increase in serum ghrelin (an orexigenic hormone), and increased hunger and appetite (in particular for calorie-dense foods with high carbohydrate content)[24].

These findings suggest that inadequate sleep could result in excessive eating and obesity, although this has not yet been confirmed. However, observational data also suggest a possible association between sleep restriction and obesity [25].

Social influences may affect one's risk of obesity. This was illustrated in a report of a social network constructed from the Framingham Offspring Study, in which an individual's chance of becoming obese increased by 57, 40, or 37 percent if he or she had a friend, sibling, or spouse who became obese, respectively. This effect did not appear to be due to social class, smoking behavior, or the tendency of people to associate with others

similar to them. This phenomenon has not been studied by other investigators, but it offers the potential for new strategies to modify the development of obesity [26].

3- Endocrine disorders:

A- Growth hormone deficiency (GHD)

Patients with GHD have an abnormal body composition with increased body fat and decreased lean body mass. Patients are often overweight or obese with central adiposity [9].

B- Cushing's syndrome

Weight gain is a prominent symptom in Cushing's syndrome. There is an accompanying deposition of fat in face, neck, abdomen and mediastinum [9].

C- Thyroid disorders

Patients with hypothyroidism often gain weight due to slowing of metabolic activity. Some of this gain is fat. The weight gain is usually modest, and marked obesity is uncommon. Increasing serum TSH concentrations within the normal range have also been associated with a modest increase in body weight in adults, but treatment of subclinical hypothyroidism does not appear to be associated with weight loss [27].

In one study of children, obese subjects had a higher serum TSH, which fell to normal levels with weight loss, suggesting the higher TSH was a result of obesity and not the cause [28].

4- Drugs:

Intake of certain kinds of drugs leads to weight gain, particularly centrally acting drugs and neuroleptics. These drugs exert their effect either centrally, affecting appetite control (eg, neuroleptics), or peripherally (eg, hypoglycemic drugs and protease inhibitors) [(9)].

5- Genetics:

Single-gene defects are known to cause obesity. These may include mutations in leptin, its receptor, and the proopiomelanocortin (PMOC) gene. The most common of these is the Prader-Willi syndrome, which is caused by a mutation on chromosome 15; other conditions include Bardet-Biedl syndrome and leptin deficiency. However, these genetic defects account for only a small portion of the obese population [(29)].

6- Hypothalamic abnormalities

The hypothalamus maintains energy homeostasis; tumours may cause disruption in its function. However, hypothalamic abnormalities are exceedingly rare causes of obesity [(30)].

The following are some of the known risk factors of obesity:

1- Socioeconomic and Ethnic factors

Obesity is linked to food insecurity, which refers to lack of food access because of low income levels [(31)].