

Recent Advances in Bariatric Surgery and Metabolic Syndrome

Essay

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List of Abbreviations

ACTH	Adrenocorticotrophic hormone
AGB	Adjustable gastric banding
BED	Binge eating disorder
BMI	Body Mass Index
BPD	Biliopancreatic diversion
BPD-DS	Biliopancreatic diversion with duodenal switch
CNS	Central nervous system
CRH	Corticotrophic releasing hormone
DJB-SG	Duodeno-jejunal bypass with sleeve gastrectomy
DVT	Deep Vein Thrombosis
DXA	Dual energy X-ray absorptiometry
EC	Esophago-cardia
ECG	Electrocardiogram
ECS	Endogenous endocannabinoid system
EWL	Excess weight loss
FDA	U.S. Food and Drug Administration
GLP-1	Glucagon-like peptide 1
HDL	High density lipoprotein
IDF	International Diabetes Federation
IGS	Implantable gastric stimulator
IVC	Inferior vena cava
JIB	Iejunoileal bypass
LAGB	Laparoscopic adjustable gastric banding
LBO	Lower body estrgen
LCDs	Low calorie diets
LDL	Low- density lipoprotein
<i>LEP</i>	Leptin
<i>LEPR</i>	Leptin receptor
LRYGB	Laparoscopic Roux-en-Y gastric bypass

List of Abbreviations (Cont.)

LSG	Laparoscopic Sleeve Gastrectomy
<i>MC4R</i>	Melanocortin-4 receptor
MGB	Mini Gastric bypass
NIDDM	In non insulin dependent diabetes mellitus
NOTES	Natural orifice transluminal endoscopic surgery
NPO	Nothing-by-mouth
NPY	Neuropeptide Y
PCOS	Polycystic ovarian syndrome
PE	Pulmonary Embolism
<i>POMC</i>	Pro-opiomelanocortin
PVN	Paraventricular nuclei
RYGB	Roux-en-Y gastric bypass
SADI	Single-anastomosis duodeno-ileal bypass
SADJB-SG	Laparoscopic Single-Anastomosis Duodenal–Jejunal Bypass with Sleeve Gastrectomy
SAGB	Single-anastomosis gastric bypass
SG	Sleeve gastrectomy
SHBG	Sex hormone binding globulin
T2DM	Type 2 diabetes mellitus
UBO	Upper body obesity
VBG	Vertical banded gastroplasty
Vd	Volume of distribution
VLCDs	Very low calorie diets
VLDL	Very low density lipoprotein
VMN	Ventromedial nuclei
WC	Waist circumference
WHO	World Health Organization
WHR	Waist/hip circumference ratio

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Recent Advances in Bariatric Surgery and Metabolic Syndrome

Abstract

Introduction: In the past several years better understanding of substantial metabolic changes induced by different surgical interventions to the alimentary tract was achieved. Therefore, the former classification of operations according to their influence on food ingestion, defined as limiting stomach capacity (restrictive), limiting absorption of nutrients (malabsorptive) or combined procedures does not appropriately reflect the current level of knowledge about early and weight-independent metabolic effects of these operations. Nowadays, most of the standard surgical interventions are being mostly referred to as metabolic operations. The focus when treating obese patients is gradually shifting from the primary goal of weight loss outcomes to the metabolic effects of the operations. Recent procedures in which long-term outcome data is not yet available include omega loop gastric bypass and Single-anastomosis duodeno-ileal bypass (SADI) with sleeve gastrectomy as a modification of duodenal switch operation .

Aim of the work: The aim of this essay is to highlight recent advances in bariatric surgery, and to give a practical systematic updated approach that can be used in the management of this condition.

Obesity is a major health problem that affects a lot of people worldwide. It almost affects every organ in the body. Obese persons may suffer from peripheral obesity with joint disease and venous stasis or central obesity that predisposes to a number of mortality-related problems due to the metabolic syndrome. Obesity is classified to: overweight, obesity class one, moderate obesity class two, morbid obesity and super morbid obesity according to the body mass index (BMI).

Bariatric surgery is the branch that studies weight loss surgical procedures. Bariatric surgical procedures are either restrictive operations that restrict the amount of food intake by reducing the quantity of food that can be consumed at one time, malabsorptive procedures that limit the absorption of nutrients and calories from ingested food or combination of both.

All the bariatric surgical procedures can be done laparoscopically as well as by laparotomy with the advantage of safety and minimal trauma.

Bariatric surgeries, including Roux-en-Y gastric bypass, are the most effective methods of curing type 2 diabetes and the other major components of the metabolic syndrome. Bariatric surgeries decrease serum LDL-C and triglyceride concentrations, whereas increases in serum HDL-C. Bariatric surgery decreases both systolic and diastolic blood pressure and also has a great effect on improvement of cardiac function and reduction of the risk of heart failure in obese patients.

Keywords: Leptin ; Laparoscopic Single-Anastomosis Duodenal-Jejunal Bypass with Sleeve Gastrectomy.

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 (*Aronne & Segal et al., 2002*).

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 (*Flier et al., 2004*).

Obesity rates are increasing worldwide. In 2008, according to the World Health Organization (WHO), 1.4 billion adults, 20 years of age and older, were overweight with an estimated 500 million adults world-wide being obese (over 200 million men and nearly 300 million women with the prevalence of obesity in children and adolescents being 16.9) (*WHO, 2013a; Frühbeck et al., 2013*).

It has been estimated that 60% of the world's population, i.e., 3.3 billion people, could be overweight (2.2 billion) or obese (1.1 billion) by 2030 if recent trends continue (*Kelly et al., 2008*).

In spite of excess weight being considered the fifth leading risk for world-wide deaths according to the WHO, it has not been possible to successfully curb the obesity epidemic with more than 40 million children under the age of 5 being overweight in 2010 (*WHO, 2013b*).

Excess weight drastically elevates a person's risk of developing a number of non-communicable diseases like diabetes, hypertension, stroke, dyslipidaemia, sleep apnoea, cancer, non-alcoholic steatohepatitis and other serious comorbidities. The WHO emphasizes that 44% of the type 2 diabetes mellitus (T2DM) burden, 23% of the ischaemic heart disease burden and around 7–41% of certain cancer burdens are attributable to overweight and obesity (*Frühbeck G et al., 2013; WHO, 2013b*).

Treatment of obesity with lifestyle or behavioural approaches is generally associated with only small reductions in bodyweight that are typically not sustained (*Dombrowski SU et al., 2014; Avenell A et al., 2004*).

Bariatric surgical interventions like adjustable gastric banding (AGB), sleeve gastrectomy (SG), Roux-en-Y gastric bypass (RYGB), biliopancreatic diversion (BPD) and BPD/duodenal switch (BPD-DS) have been associated with substantial weight loss, decreased morbidity, and improvements in quality of life (*Sjöström et al., 2013; Picot et al., 2009*). Despite the escalating use of bariatric surgery, the evidence based supporting use of these procedures for obesity and obesity-associated morbidity is scant.

In the past several years better understanding of substantial metabolic changes induced by different surgical interventions to the alimentary tract was achieved. Therefore, the former classification of operations according to their influence on food ingestion, defined as limiting stomach capacity (restrictive), limiting absorption of nutrients (malabsorptive) or combined procedures does not appropriately reflect the current level of knowledge about

early and weight-independent metabolic effects of these operations. Nowadays, most of the standard surgical interventions are being mostly referred to as metabolic operations. The focus when treating obese patients is gradually shifting from the primary goal of weight loss outcomes to the metabolic effects of the operations (*Korner et al., 2009; Briatore et al., 2008*).

Recent procedures in which long-term outcome data is not yet available include omega loop gastric bypass and Single-anastomosis duodeno-ileal bypass (SADI) with sleeve gastrectomy as a modification of duodenal switch operation (*Talebpour et al., 2007; Sánchez-Pernaute et al., 2012*).

Aim of the work

The aim of this essay is to highlight recent advances in bariatric surgery, and to give a practical systematic updated approach that can be used in the management of this condition.

Chapter one

Definition and diagnosis

Definition:

Obesity is simply defined as "excessive amount of body fat" and should be considered a chronic disease, as it has definite mortality and morbidity (**Scheen et al., 1994**).

The terms obesity and overweight mean different things to different people, defining obesity and overweight has been the focus of scientific study for hundred of years (**Bray, 1998**).

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 (**Flier and Flier, 2008**).

Obesity is the most common form of malnutrition in developed countries, prevalence of obesity is rising to an epidemic proportion around the world (**Lin et al., 2003**).

Obesity is one of the most prevalent health problems in the western world. Obesity increases the risk of medical illness and premature death and thus imposes an enormous economic burden on the health care system. Obesity is also associated with a reduced quality of life resulting from substantial limitations and restrictions in activities of daily living (**Mauro et al., 2008**).

Diagnosis:

Measurement of body fat mass is extremely challenging, because no direct method exists other than in vivo neutron activation analysis (very limited availability) and chemical analysis of the cadaver (useful for animal studies only). The lack of direct methods has led to development of various models and indirect methods for estimation of fat and fat-free mass, all of which are imperfect and require a number of assumptions (Lohman, 1996).

I- Methods for measuring total body fat:**A- Anthropometric measurements:****1. Weight and height:****a) Relative weight:**

This approach involves dividing the weight by standard weight that is based on patient's height. The standard weight used most frequently are those published by the Metropolitan Life Insurance Company which are based on the weight associated with the lowest mortality at any given height. Obesity is defined as being 125% of one's ideal weight, whereas superobesity is 200% of one's ideal weight (Benotti and Forse, 1995).

The Metropolitan tables have been considered as being inaccurate because:

- Insured subjects do not represent a random sample of population.
- Insured subjects are screened for illness and so are healthier than average.
- About 20% of the subjects used in tables reported their heights and weights but were not actually measured. Women tend to under report their weight but men tend to over report their weight.