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Reduction of Weight in Morbid Obesity: Medical and Surgical Advance

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Abstract

Morbid obesity is a result of poor diet management, a lack of exercise and education. Excessive fat accumulation peripheral and visceral results in developing the major risk factors for causing more years of disability, morbidity and mortality. Unless the populations and medical societies take professional procedures for getting ideal problem solutions, numerous of serious recognized public health problems will be developed. Understanding the pathophysiological bases of morbid obesity is the corner stone to solve the problem. The aim of the present article is reviewing and discussing the bases of current applied management tools for controlling morbid obesity by assessing different trails in the last decade.

Keywords: Morbid obesity; Weight reduction; Bariatric surgery

Introduction

The forced prevalence increase of obesity and particularly morbid obesity (MO) has become a major global health challenge. Obese individuals gain body mass index (BMI) more than 30 Kg/m^2 with different physical changes based weight and height. In 2013, the prevalence of overweight (BMI: 25 Kg/m^2 – 30 Kg/m^2), obesity and MO (BMI >40 Kg/m^2) increased in children and adolescents in developing countries from 8.1% to 12.9% for boys and from 8.4% to 13.4% in girls [1]. Until now, few national success stories have been reported and imperative global actions are required.

There is no doubt that, MO increases the risks of developing several diseases. It is associated with type 2 diabetes, cardiovascular disorders, hypertension, dyslipidemia, gall bladder disease, osteoarthritis, sleep apnea, depression and certain cancers, such as ovary, breast and colon [2-4].

Innovative doing well control programs require careful understanding the prevalence and the biochemical bases of obesity and associated co-morbidity in different age groups. Several studies reported that, medical and surgical treatment programs are occasionally applied to treat morbidly obese patients and surgery seems to have the successful and the longest period of sustained weight loss [5,6].

Pathophysiological Hypotheses of Obesity

Commonly, obesity arises when energy intake, exceeds energy expenditure. Excess of body fats or free fatty acids are stored in subcutaneous adipose tissue, visceral adipose tissue and non-adipose tissue (e.g. liver, skeletal muscle and heart) causing steatosis complications [7,8]. Some medications such as anticonvulsants and antidepressants are adding factors for excess fat storage in the body [8].

There are many possible pathophysiological mechanisms involved in the development and maintenance of obesity. This field of research had been nearly un-approached successfully until the leptin discovery two decades ago. Leptin is a satiety factor. It plays a key role in regulating energy intake and energy expenditure, including appetite and metabolism. Since leptin's discovery, ghrelin, cholecystokinin, adiponectin, insulin, orexin, as well as many other mediators have been broadly studied [9]. The adipokines are mediators produced by adipose tissue; their action is thought to modify many obesity-related diseases. They have insulin-sensitizing, anti-atherogenic, and anti-inflammatory actions [3,8].

Leptin and ghrelin are harmonizing in their influence on appetite. Ghrelin produced by the stomach modulating short-term appetitive control (i.e. to eat when the stomach is empty and to stop when the stomach is stretched). Leptin is produced by adipose tissue to signal fat storage reserves in the body, and mediates long-standing appetitive controls (i.e. to eat more when fat storages are low and less when fat storages are high). While leptin and ghrelin are produced peripherally, they and other appetite-related hormones act centrally for the regulation of food intake and energy expenditure [10,11].

Burden of Morbid Obesity

Adipose tissues produce anti-inflammatory and pro-inflammatory bioactive molecules that burden of obesity-related diseases [12]. Subcutaneous fat has a low relationship with the development of chronic disease such as cardiovascular disease and diabetes. It acts in a protective manner "metabolic sink". On the hand, visceral fats produce non esterified fatty acids that in turn endorse increasing biosynthesis of triglyceride in the liver. Increased fasting triglycerides cause visceral fat accumulation and followed by increased waist circumference [13]. Thus central (visceral) adiposity is associated a greater health risk than peripheral adiposity [3,14].

Most trend estimates indicated that, MO rates continue to rise rapidly in both genders of adults and childhood and has a greater risk for illnesses [15-17]. The number of the adipose tissue macrophages is increased [18]. In turn, macrophages increase all adipose tissue TNF-α, IL-6, and other acute-phase response markers and mediators of inflammation [19].

Inflammatory markers may play a role in causing insulin resistance and other metabolic abnormalities [6]. In addition, MO decreases chances of successful pregnancy. It induces an ovulation, increases the rate of miscarriage among obese women [20] and decreases male fertility by lowering total and free testosterone levels. On the other hand, there is no sufficient data to confirm an effect of obesity on semen parameters [21].

Trails Controlling Morbid Obesity

Most conventional management programs used a combination of diet, physical exercises, behavioral treatment, and/or drugs [22]. Although the medical approach is the first-line of management, it has limited short-term success and very poor long-term success in severe obesity. Weight loss surgery (WLS) generally results in greater weight loss than conventional treatment, and leads to improvements in quality of life and obesity co-morbidity [23].

Medical Therapy

The first line of treatment for obesity is dieting, augmented by physical exercise. These may be supported by cognitive behavioral therapy by altering either appetite, or absorption of calories. Calories-restriction strategies are one of the most common dietary plans. Low-calorie diet refers to a diet with a total dietary calorie intake of 800-1500 [22]. A meta-analysis by Fock KM et al. [22] recorded that, by calorie restriction and exercise, weight loss of 5-8.5 kg was observed 6 months after intervention. After 48 months, a mean of 3-6 kg was maintained.

In the United States, for long term use, only one anti-obesity medication orlistat is currently permitted by the FDA. It reduces intestinal fat absorption by inhibiting pancreatic lipase [24]. Sibutramine drug acts in the brain to inhibit deactivation of the neurotransmitters, thereby decreasing appetite. Due to its cardiovascular risks, it was withdrawn from the United States [25]. Rimonabant drug works via a specific blockade of the Endocannabinoid system. Due to safety concerns, it has not received approval in the United States but had been approved in Europe for the treatment of obesity [26].

Because of potential side effects, anti-obesity drugs are only prescribed for obesity where the profits of the treatment response compensate its risks. Appetite is a very important instinct to promote survival. Possibly, any drug that would do away with appetite may carry a high mortality risk and may be inappropriate for clinical use. Because the human body uses various mediators to protect its stores of fat, anti-obesity drugs are not a realistic long-term solution for people who are overweight [27].

Bariatric surgery (weight loss surgery)

As the morbid obese poorly responses to routine management, weight loss surgery is considered the only therapeutic alternative. It includes a variety of measures performed on obese individuals. Weight loss is achieved by reducing the size of the stomach with, a gastric ballooning, a gastric band or through removal of a portion of the stomach (biliopancreatic diversion with duodenal switch or sleeve gastrectomy) or by resecting and re-routing the small intestine to a small stomach pouch (gastric bypass surgery) [28].

The American College of Physicians recommends bariatric surgery for obese people with a BMI of at least 40, and for people with BMI 35 and serious coexisting medical conditions such as diabetes [8]. The recent guidelines propose that any patient with a BMI of more than 30 with comorbidities is a candidate for bariatric surgery [29].

Long-term studies confirm the measures cause significant long-term loss of weight, recovery from diabetes, improvement in cardiovascular risks, and a reduction in mortality of 23% from 40%. Laparoscopic gastric surgery for morbid obesity was associated with a substantially longer survival and improved acute outcomes than diet and exercise therapy [30]. However, Arterburn et al. [31] had found no survival benefit associated with bariatric surgery among older, severely obese people when compared with usual care, at least out to seven years.

Pre-operative preparation

Performance of bariatric surgeries touch different problems: Combination of a comorbidities with technical, surgical and anesthetics problems, excess of intra-abdominal fat decreases the technical safety. Visceral fat is a source of inflammatory mediators which are associated with increased adipose tissue vascularization and perfusion [13]. Therefore, WLS necessitate preoperative weight loss as an important step for reduction of comorbidities and minimizing the technical obstacles and risks.

Many researchers approved preoperative losing at least 10% of patient's weight. Thus results in: improvement of the cardiovascular risk and co-morbidities, shortening the bariatric surgical time, limitation of the potential difficulties and both surgical and anesthetics complications, reduction of blood loss, shortening of hospital residence and reduction of morbidity and mortality of the surgical procedures. In addition, decreasing visceral fats in particular, the hepatic steatosis and liver volume [30].

Some protocols programmed MO patients to be treated 20 days prior to bariatric surgery with a balanced energy formula diet. Based on 200 Kcal every 6 hours for 12 days, only clear liquids in the last eight days prior to surgery [32].

Another protocol identified the very low calorie diet to contain less than 800 kcal per day for reduction of liver volume. It based on low carbohydrate and fat and/or high protein diets for rapid weight loss. Over all the dietary regimes need to be balanced in macronutrients, minerals and vitamins [22].

In 2014, Norén and Forssel [33] assessed four weeks treatment with fructose containing very low calorie diet (approximately 680 kcal per day). It gave a substantial weight reduction and significant reduction in cholesterol and triglyceride levels as well as in systolic blood pressure.

Surgical approach

Laparoscopic gastric banding (LAGB): It is an inflatable silicone device that wraps around the top portion of the stomach, dividing the stomach into a small upper pouch and a larger lower stomach. The degree of band tightness affects how much food one can eat and the length of time it takes for food to leave the stomach**.** Although it is supposed as a safer, minimally invasive, fully reversible and adjustable procedure, it is thought to be less effective than other bariatric surgeries [34].

Roux-en-Y gastric bypass (RYGB): It based on creating a small stomach pouch and attaches a section of the small intestine directly to the pouch. This allows food to bypass a portion of the small intestine resulting in a reduction of the amount of calories (in the form of nutrients) that are absorbed. Many studies indicate that gastric bypass surgery may have a ripple effect and considerable variation in the postoperative weight loss of followers [35].

Laparoscopic Sleeve gastrectomy (LSG): The sleeve gastrectomy has demonstrated benefits comparable to other bariatric and does not significantly affect normal digestion and absorption. It is a thin vertical sleeve of stomach is created using a stapling device. The sleeve is about the size of a banana. The rest of the stomach - around 75% - is removed leaving a narrow gastric tube or "sleeve to give a size of a banana. It creates five or six small incisions in the abdomen with laparoscope. Duration time is (1-2) hours to complete [36].

Laparoscopic Nissen fundoplication with gastric plication (LNFGP): Laparoscopic Nissen fundoplication is considered the standard surgical approach for treatment of severe gastroesophageal reflux disease. However, there is no consensus for the surgical treatment of reflux in morbidly obese patients [37].

Gastric Ballooning: Under guidance and vision using a gastroscope, an inflatable balloon is placed-under sedation- in the stomach. In most patients, weight loss occurs in the first few months and then slows down. Patients are usually very uncomfortable in the first week and early removal may be required due to intolerance of the device [29].

Nowadays, the selection of bariatric surgery protocol is based mainly on patient conditions and surgeon preference with significant varies among regions of the world. All balloons are temporary and necessitate to be removed after a period of time. The intragastric balloon device is not considered an enduring weight loss procedure. It is primarily used to provide initial weight loss in severe MO prior to definitive surgery to make it safer or may be used in patients who don't qualify for ultimate surgery. LAGB is mostly common procedure in United States, Europe and Australia. However, RYGB procedure is less distributed; despite the majority of available data explore the RYGB produces with greater weight loss with metabolic syndromes patients. LSG is accepted and approved for the treatment of morbid obesity under several indications and achieving considerable weight loss. Several studies showed that morbid obesity and the associated co morbidities were successfully managed by LSG with different age scales even in children of 5 and 6 years of age [38-42].

Risks of bariatric surgery

Long term presence of gastric balloon may cause rigorous complications such as perforation of the stomach. Abdominal hernias are the most common complications of gastric bypass surgery. Other rare complications include leakage through staples or sutures, ulcers in the stomach or small intestine, stretching of the pouch or esophagus, persistent vomiting, abdominal pain, and inflammation of the gallbladder. On the other hand, slippages of the band and/or incision are the most serious side effects of gastric banding. Further side effects include nausea, vomiting, heartburn, and abdominal pain. Due to reduced calcium absorption, metabolic bone disease manifesting as osteopenia and secondary hyperparathyroidism with increased risk of fracture have been reported after Roux-en-Y gastric bypass surgery. Regarding LSG, Early postoperative complications following LSG that need to be identified urgently include bleeding, staple line leak and development of an abscess. Delayed complications include strictures, nutritional deficiencies and gastroesophageal reflux disease [29,34-37].

Post-operative management

After the operation, a barium X-ray study is performed to check the size of the stomach pouch and to exclude a leak from the stapled edge of the stomach. A proton pump inhibitor may be given to decrease gastric acid production and to prevent heartburn. After the procedure, the patient will start on clear fluids and will need to be sipped slowly in small amounts. On the long run, nearly, one-third of the patients may develop gallstones, nutritional deficiencies such as anemia, osteoporosis and metabolic bone disease. These deficiencies can be avoided if vitamin and mineral intakes are maintained. Gallstones can be prevented with supplemental bile salts taken for the first six months after surgery [23,41].

Discussion

Severe obesity is a major public health problem that contributes significantly to an increase in both morbidity and mortality with subsequent socio-economical disabilities. Is it possible to discard the morbid obesity as a medical and social problem forever? Dream is possible to come true if biomedical and genetic bases of over-weight and its control are clear. Adipose tissue synthesizes and secretes many peptides that are involved in the regulation of energy homeostasis, insulin action and lipid metabolism. Although visceral adipose tissue can cause metabolic abnormalities by secreting inflammatory adipokines which induce insulin resistance, it might have beneficial metabolic effects by producing adiponectin.

Approximately, the majority of the reviewed weight reduction programs documented dieting and physical exercise are the main line of management for obesity. Both may produce weight loss over the short term, but maintaining this weight loss is frequently difficult. Thus often requires making exercise and a lower food energy diet a permanent part of a person's lifestyle. All types of low-carbohydrate and low-fat diets appear equally beneficial. On the other hand, bariatric surgery has been shown to be an alternative effective method for achieving sustained weight loss and improvement in comorbidities.

Up to date, LSG is appreciated to help morbid obese people to lose weight. In addition, and according to Freeman et al. [43] LSG is a safe and effective means for addressing obesity in kidney transplant candidates in the context of a multidisciplinary approach with significant blood pressure reduction.

Currently, LSG is accepted by nearly all researchers to be a durable in the near future and effective in the management of morbid obesity. It has more advantages over the other WLS. This because of the short operation time is an urgent advantage for patients with comorbidity, reducing the size of the stomach to limits the diet and without misbalances of absorption for nutrients in small intestines. In addition, removing the gastric fundus which is the primary site of ghrelin production, enhance weight loss by reducing appetite. Likewise, preliminary unpublished collected data from our last five years experience in the management of morbid obesity in AL-Rass General Hospital, Qassim-Saudi Arabia, are in agreement with these facts. Moreover, we recorded a surprising encouraging data regarding the outcomes of LSG in MO with co-morbidities. Final results with five years follow-up will be published afterward.

Accordingly, in 2012, there was a precipitous increase in the use of LSG (36%) with a concurrent reduction in the use of laparoscopic Roux-en-Y gastric bypass (LRYGB, 56%) and a major reduction in laparoscopic adjustable gastric banding (LAGB, 4%) in the United States [39-41].

Conversely, and according to Paulus GF et al. [44] meta-analysis, LSG is non-reversible and may not be the right procedure for everyone who wants to lose weight. Complications occur in about 17% of cases and reoperation is needed in 7% of cases. No data regarding weight-loss, complications or weight regain beyond 3-5 years after operations. The medications in LSG patients postoperatively are still unclear, specifically in the immediate postoperative periods following surgery.

That's why; further studies are needed for understanding the long-term benefits and risks on different physiological and biochemical markers of lifestyles. In addition, follow up is essential for monitoring the growth and development of young cases subjected to LSG. Due to its cost and possible risks, researchers are asked to search for other effective yet less invasive approaches.

The existing early and preliminary results of applying genotype data to obesity management are promising. Recognition and categorization of susceptibility genes underlying morbid obesity will throw in more understanding of the pathophysiology. This will assist in the development of better strategies and less risky interventions. Upcoming scenarios are heartening to make this come true.

Conclusion

Medical program may produce weight loss over the short term, but

maintaining this weight loss is frequently difficult. It often requires making exercise and a lower food energy diet a permanent part of a person's lifestyle. Also, as the human body uses various mediators to protect its stores of fat, anti-obesity drugs are not a realistic long-term solution for people who are overweight. Bariatric surgeries add potential benefits for getting the best lifestyle against different risks. LSG is accepted – in spite of some disadvantages - as the best and has more advantages over the other WLS. Further studies in the new field of gene therapy and searching for less risky interventions are required.

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