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Laparoscopic Sleeve Gastrectomy for Severe and Morbid Obesity: A Narrative Literature Review

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A B S T R A C T

The prevalence of severe and morbid obesity keeps increasing in significant value and has become a major problem around the world. Society itself, whether in young adult or senior, currently keep looking to manage them. The current effective and approved treatment for this condition is known as metabolic and bariatric surgery (MBS), in which there are several procedures, including laparoscopic sleeve gastrectomy. Even though knowledge regarding this procedure keeps evolving, the study found that the laparoscopic sleeve gastrectomy procedure brings minimal complication with quality-of-life improvement, especially in a cardiometabolic risk society. This review aims to further discuss the procedure definition, changes in diet, benefits, and obesity relapse in the future after this procedure.

1. Introduction

Individuals who stand at 30 kg/m^2 of body mass index (BMI) are identified as obese.[1] Whereas if it continues to reach 40 kg/m^2, known as class III obesity or severe obesity, and if it is seen with significant comorbidities, it would become morbid obesity.[2] Obesity, also known as a disease, rise from non-functional adipose tissue aggregation and causes metabolic, biomechanical, and psychosocial problem, which could happen as a relapsing neurobehavioral component.[3] According to the CDC, obesity and severe obesity have become a global healthcare main problem, and its prevalence among adults continues to grow from time to time.[4] Furthermore, the study said this disease had produced healthcare costs from 120 USD to more than 18 million USD for every 100000 patients with obesity-related comorbidities ranging from hypertensive heart disease to osteoarthritis.[5]

There are several evidence-based approaches to obesity management, including behavioral changes, pharmacotherapy, and bariatric surgery.[6] American Society for Metabolic and Bariatric Surgery stated that bariatric surgery has significant benefits and shows improvement in many related diseases with severe

obesity. Although the development of this method continues, many studies suggest that there are benefits felt by the patient from this method.[3] Then, the physician as a team could consider this procedure for the patient. This review aimed to further discuss the procedure definition, changes in diet, benefits, and obesity relapse in the future after this procedure.

Procedure definition

Back in 1954, bariatric surgery was performed by a surgeon named Karmen, based on the observation that sustained weight loss can be achieved with secondary malabsorption.[7] At that time, the surgical procedures were essentially shortened and bypassed the pathway between the stomach and intestines, but nowadays, this legacy of old bariatric surgery is no longer performed by the Surgeon.[7] In 1978, Buchwald and Varco, two surgeons from Europe, proposed the word "metabolic" should be added to the front of bariatric surgery. They presume that this surgical procedure has an effect on the metabolic condition. Until now, a lot of study centers have continued to perform metabolic and bariatric surgery safely, such as the American Society of Bariatric Surgery, the American College of Surgery Bariatric Surgery Centre Network, and many more.[8]

Bariatric surgery is known as any procedure that involves gastric bypass in order to decrease the body weight and reduce any other comorbidities effect.[9] Based on the function and mechanism itself, there are three categories divided bariatric surgery, malabsorptive procedures, restrictive procedures, and the combined procedure. All of these three categories were permanent, and the most frequent technique used worldwide is the sleeve gastrectomy (SG) (45.9%), Roux-en-Y gastric bypass (RYGBP) (39.6%), and adjustable gastric banding (AGB) (7.4%).[8,10] The sleeve gastrectomy itself belongs to the restrictive procedure, which creates a satiety sensation early by cutting the capacity of the stomach to hold the food bolus (Figure 1).[8]

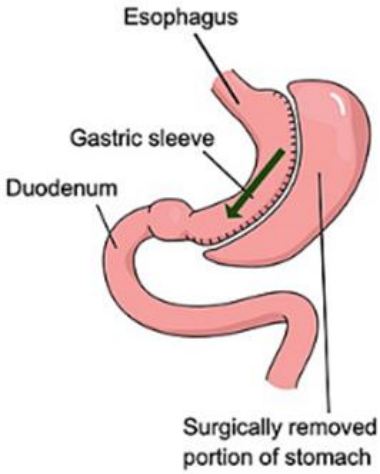

Figure 1. Sleeve gastrectomy procedure.[10]

Sleeve gastrectomy (SG) was founded by Dr. Michael Gagner as a single operating procedure and derived from its predecessor, the Duodenal Switch procedure.[8] It can be done with open laparotomy, but it evolved into laparoscopic sleeve gastrectomy. After securing the liver and some blood vessels around the stomach, the procedure starts with creating a tabularized stomach in 30-40 French measurements in diameter. This tube, or called bougie, acts as a dilator inserted until around 4-6 cm proximal to the

pylorus along the lesser curvature. After that, the stapler device was used to cut nearly 2/3 part of the stomach, leaving no excessive fundus. The stapler device should parallel with the lesser curvature and be divided with the bougie to ensure that the gastric outlet is safe.[11]

Surgical consideration

There are important things to consider before suggesting the patient take this procedure was intended to avoid any unwanted events, including patient selection and preoperative examination. According to the American Society for Metabolic and Bariatric Surgery (ASMBS) and the National Institute of Health (NIH), patients with the following qualifications/indication could undergo the sleeve gastrectomy procedure (Table 1). We should also suggest the patient should look after a qualified, experienced, and certified Surgeon in bariatric surgery.[11]

Table 1. Qualification of the patient that can receive bariatric surgery.[11]

Patient qualification
1. Age range between 18-64 years old (men/woman), 2. He/she has ≥ 40 kg/m^2 of body mass index, 3. He/she has ≥ 35 kg/m^2 of body mass index but accompanied by one of the following morbidities; type II diabetes mellitus, hypertensive heart disease, non-alcoholic related liver disease, joint problem, abnormal lipid number 4. Unable to get and maintain healthy weight loss.

As with other surgical procedures, in this bariatric surgery, the patient also needs to do some examination preoperatively.[7] The ASMBS guidelines have added some evaluation prior to this procedure instead of complete routine history and physical and surgical risk evaluation. It includes the evaluation of existing comorbidities, psychosocial and behavioral conditions, the patient needs to seek a nutritionist or diet expert following to procedure, and also the patient needs to explain the condition post-operatively.[7,11]

Physiological benefits and changes

The patient can achieve many benefits after the bariatric procedure is done. However, there will be some physiological changes that will accompany the advantages of this procedure. The most visible thing after the procedure was taken is the satiety control management. The study said 95% of the patient could control their food appetite if the fundus resection was done properly. This could happen because the sleeve gastrectomy procedure eliminates ghrelin hormone production. Ghrelin is mainly secreted in the greater curvature inner mucosa, especially in the fundus area.[12]

Ghrelin is a hormone produced by our body that can affect the growth hormone release and is a predominant factor in the management of body weight because it encourages us to have an appetite and begin to take a meal. However, the changes in these hormones are different in every study. Several studies found that 65% of the patients post-operatively had the permanent result of the ghrelin hormone compared to the control subject, but the other study said ghrelin reduction happens only in the postoperative period and increases after 2 months with blaming on the incomplete fundus resection. Furthermore, some hormones changes associated with weight loss after the sleeve gastrectomy procedure can be seen in the table below (Table 2).[12]

Table 2. Hormones related to the sleeve gastrectomy.

Gastric hormones	Sources	Function	State after sleeve gastrectomy
Ghrelin	Fundus area of gastric (greater curvature), small intestine, and pancreas	Encourage the GH production against the action of the leptin hormone	↓↓↓↓ Reducing appetite, increasing fat metabolism, and metabolic rate
peptide-YY	Enteroendocrine cells in the ileum and colon	Connected with insulin released	↑↑↑↑ Promotes the satiety sensation
Leptin	Lipocytes or fat cells	Suppress the neuropeptide-Y and stimulates the proopiomelanocortin neurons in the brain	↑↑↑↑ Promotes the anorectic state

Benefit sleeve gastrectomy in BMI

Sleeve gastrectomy has proved to be significantly decreased the BMI in many studies, including every race in every center. The study revealed among 130 Koreans, the mean excess weight loss (EWL) was 71% for the last 6 months and increased to nearly 83% at 12 months.[13] The impact of sleeve gastrectomy was also noted on adolescents under 18 years old, where France surgeons take analysis to 84 patients with weights around 128 kg and a BMI mean of 43.7 kg/m^2. This study mentioned that after sleeve gastrectomy, the BMI reduced as lower as 28.8 kg/m^2 with 29.1% of the body weight successfully removed. All the under 18 years old patients achieve a significantly increased quality of life because of comorbidities remissions.[14] Cohort study on 125 patients post sleeve gastrectomy shows the monocyte-to-high-density lipoprotein cholesterol ratio (MHR) significantly decreased due to the increase of EWL percentage at 6 months after the procedure.[15] Almost every study found that sleeve gastrectomy significantly reduces the BMI through weight loss, and it makes cardiovascular risk also decreasing.

Benefit sleeve gastrectomy in the cardiovascular system

In 2021, an Italian Surgeon conducted an analysis of 46 patients 6 months after sleeve gastrectomy. The data shows that 100% of the patient has significantly increased their pulmonary ventilation function at rest and during exercises compared to the same function before sleeve gastrectomy.[16] Even more, a study of 41 severe obesity patients (BMI ≥ 44kg/m^2) in men and women revealed that 9 months after sleeve gastrectomy, the obesity was gone, and the circadian expression was less shattered and more stable with improving sleep quality.[17] Then, there are 44 morbidly obese analyzed regarding the diameter of the aortic in systolic and diastolic, the diameter of the left ventricular, cardiac output, and ejection fraction after getting the sleeve gastrectomy. These studies show because of weight loss, 76% of the patient has a convincing change in left ventricular thickness, cardiac output, and ejection fraction.[18] Cohort analysis into 6256 patients post sleeve gastrectomy showed the risk for getting arteriosclerotic cardiovascular disease (ASVCD) reduced to 2.6%, 3.0%, and 4.1% for 1, 5, and 10 years respectively.[19]

Benefit sleeve gastrectomy in metabolic disease and degenerative bone disease state

China's 2021 study involving 36 patients with insulin resistance (IR) type 2 diabetes mellitus shows that sleeve gastrectomy effectively proposed IR remission. This condition was achieved within 6 months after surgery.[20] Furthermore, sleeve gastrectomy is said to significantly increase the glucagon-like peptide-1 (GLP-1) hormone, the HbA1c, and post-prandial serum C-peptide in 36 adolescents who experienced type 2 diabetes mellitus (DM). Even this study mentioned that smaller size antrum left during sleeve gastrectomy was connected to 88.9% of

type 2 DM remission of that patient.[21] A randomized control trial was done in 2018 on 205 patients undergoing sleeve gastrectomy compared to other procedures show that sleeve gastrectomy could improve the degenerative joint problem nearly in 45 patients and it dissolved in 68 patients.[22]

Future weight regain

After a successful sleeve gastrectomy procedure in terms of reducing obesity-related morbidities, as a physician, we have to persuade the patient to maintain the condition by any means. In 2016, there is a systematic study on 2 years after sleeve gastrectomy. It was found that the WR ranged from 5.7% to 75.6% during the first 2 years until 6 years and was mainly caused by the initial size of the gastric sleeve, adequate follow-up regarding diet pattern, and lifestyle.[23] Another systematic study on several factors on how weight regain (WR) could happen after sleeve gastrectomy was found that 1 out of 6 patients undergoing sleeve gastrectomy had WR more than 10%, and it caused by surgical anatomy failure, hormonal and genetic, diet pattern, psychological condition after the procedure. Among those factors, the hormonal, genetic, and diet pattern after the procedure plays a significant role.[24]

2. Conclusion

Metabolic bariatric surgery is the newest method for treating obesity and severe obesity. The patient shows no remarkable improvement in the previous management, especially in obesity-related comorbidities. Despite any evolving knowledge, many studies discovered this technique could be considered by team physicians (internists, cardiologists, and Surgeons) related to a patient with an obesity problem that shows no response to conservative treatment. Furthermore, the patient needs to be involved in preventing the relapse of excessive weight.

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