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CHOOSING BETWEEN ROUX-EN-Y AND SLEEVE GASTRECTOMY FOR MORBID OBESITY BARIATRIC SURGERY

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Abstract: Obesity is a worldwide epidemic affecting millions of people. Bariatric surgery is one method for tackling morbid obesity in people with a body mass index greater than 30 kg/m^2. Vertical Sleeve Gastrectomy and Roux-en-Y gastric bypass (RYGB) are surgical techniques currently used in bariatric surgeries. It is critical to assess the benefits and drawbacks of each surgical technique to select the best option for each patient. Sleeve gastrectomy and RYGB were compared regarding patients' age, gender, ethnicity, weight loss, weight gain, early post-surgical complications, systemic hypertension, diabetes, and dyslipidemia. Studies about Sleeve and Gastric Bypass bariatric surgeries in adults who experienced weight loss and were published in the last five years were selected for a systematic review following the PRISMA guidelines. Non-human studies, nonrandomized studies, studies on gastric banding, and studies that did not address the topic or were irrelevant to the work were excluded. The mean age of the 45 studies chosen was 42 years old, with most patients female (63.2%). Despite a higher risk of post-surgical complications, RYGB was more effective than sleeve gastrectomy for systemic arterial hypertension, diabetes, dyslipidemia, and weight loss. Setting weight loss goals should be a collaborative effort between the doctor and the patient, and the limitations, risks, and benefits of bariatric surgery should be discussed before.

Keywords: obesity, bariatric surgery, weight loss, Sleeve Gastrectomy, Roux-en-Y Gastric Bypass.

Abbreviations: RYGB, Roux-en-Y Gastric Bypass; SG, Gastric Sleeve/Vertical Gastrectomy; BMI, Body Mass Index; GERD, Gastroesophageal Reflux Disease.

INTRODUCTION

Obesity is defined by a body mass index (BMI) greater than 30 kg/m^2 (1). It is a condition characterized by hormonal, inflammatory, and endothelial changes (2) leading to the accumulation of excessive fat in tissues, as opposed to increased body weight, which can be caused solely by an increase in muscle mass and does not pose the same risks and comorbidities (3). Global obesity has nearly tripled since 1975 (4). In 2016, more than 1.9 billion adults (39%) were overweight, and 650 million (13%) were obese (4). Obesity increased from 3.2% in 1975 to 10.8% in 2014 in men and 6.4% to 14.9% in women in a study of 19.2 million people from 186 countries (5). Severe obesity (body mass index of 35 kg/m^2) affects approximately 2.3% of the world's male population and 5.0% of the female population (5). Globally, the prevalence of severe obesity is 0.64% in men and 1.6% in women (5).

This disease results from multiple factors, including cultural, dietary, socioeconomic, metabolic, genetic, behavioral, and political factors (6). An energy imbalance between intake and expenditure causes fat accumulation. The primary hormone associated with obesity is leptin, a peptide from the class of adipokines synthesized by adipocytes that plays a vital role in both energy expenditure and food intake. Leptin works by decreasing appetite and increasing caloric expenditure. Glycine, on the other hand, promotes fat accumulation by increasing food intake and, as a result, adipose tissue expansion.

Furthermore, insulin, glucocorticoids, and pro-inflammatory cytokines increase adipose synthesis, whereas testosterone, catecholamines, and cold temperatures decrease it. Obesity is also linked to cortisol, estrogen, triiodothyronine, and thyroxine levels. Any shifts in these hormone levels cause an imbalance and result in abnormal body fat accumulation (7).

Excess body fat causes a cascade of homeostatic changes at a systemic level, affecting multiple organs and structures. The consequences of this condition are mainly due to chronic inflammation caused by a specific set of pro-inflammatory adipokines. Inflammation induces oxidation and apoptosis in the central nervous system, including the hunger center in the hypothalamus and neurocognitive areas, increasing the risk of dementia. Adipokines are also involved in coronary artery calcification, vascular dysfunction in the brain, and muscular, renal, and other tissue repercussions. Furthermore, hyperlipidemic states can overstimulate the sympathetic and renin-angiotensin-aldosterone systems, leading to systemic arterial hypertension (7). Obesity also increases the risk of developing Type 2 Diabetes Mellitus by causing hyperinsulinemia (7).

Bariatric surgery is recommended for patients who meet the following criteria: BMI 40kg/m^2 or BMI 35kg/m^2 with associated comorbidities, previous non-effective clinical treatment for at least two years, healthy mental status, no history of alcoholism or illicit drug usage, patient and family awareness about surgical risks, and age between 18 and 65 years old (may start at 16 years old with guardian endorsement) (8). The comorbidities are related to diseases that can be aggravated by obesity, such as diabetes, sleep apnea, systemic hypertension, dyslipidemia, cardiovascular diseases, severe uncontrolled asthma, osteoarthritis, herniated discs, gastroesophageal reflux, cholelithiasis, recurrent acute pancreatitis, hepatic steatosis, male and female infertility, erectile dysfunction, polycystic ovary syndrome, varicose veins, hemorrhoidal disease, idiopathic intracranial hypertension, and depression (8). Before surgery, patients need to be counseled by a multidisciplinary team who will advise about the changes in lifestyle required in the postoperative period, including nutritional evaluations over time and regular physical activities to avoid regaining weight (9).

Physicians should consider the patient's risk of surgical complications and the surgery's potential to improve life expectancy and quality of life. Gastric Sleeve/Vertical Gastrectomy (SG) (Figure 1) is performed by dissecting the distal portion of the gastric body to the esophagogastric angle and up to 2 cm from the pylorus. Adhesions in the diaphragmatic crura and peritoneum are released, and the posterior gastric artery is ligated. Next, stapling and transmural suturing are performed at both ends of the stomach, forming a gastric tube. A leakage test of the stapling line is performed with methylene blue. If there is no content leakage, the stomach is removed by one of the trocars, and the skin is sutured, ending the surgery. With the advancement of Sleeve surgery, there are more advanced techniques in which there is no need for suturing after stapling (10).

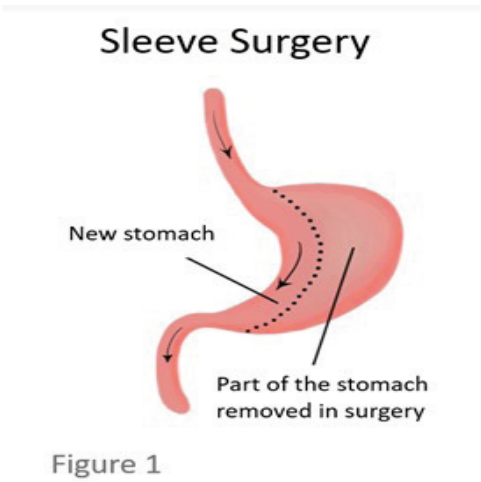

Figure 1. Gastric Sleeve/Vertical Gastrectomy (SG) representation.

In Roux-en-Y Gastric Bypass (RYGB) (Figure 2), the esophagogastric angle is dissected, extending to the small curvature and the omental pouch. A gastric pouch is

created. The stomach is cut horizontally and stapled towards the esophagus. The remaining gastric portion is removed via vertical resection, leaving space through which the bolus can pass. The intestine is elevated in the direction of the hiatus to perform the gastrojejunal anastomosis. The lateral-lateral jejunojejunostomy is the following procedure: the biliopancreatic loop is sutured to the gastrojejunal loop to allow bile and pancreatic juice to pass. Any mesenteric defects are closed to prevent hernias. Finally, a methylene test is performed to check the gastrointestinal tract for leaks (11).

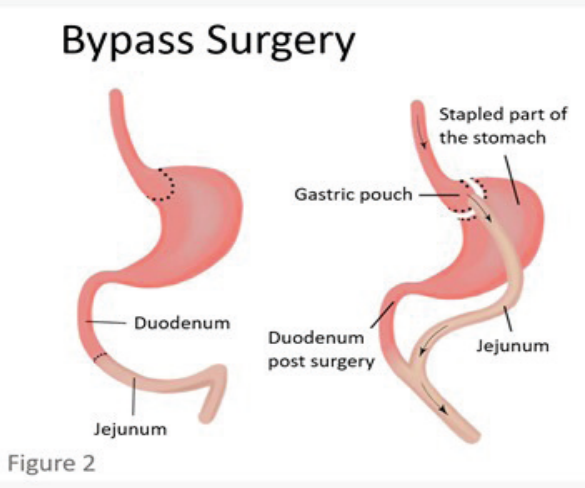

Figure 2. Roux-en-Y Gastric Bypass (RYGB) representation.

This systematic review aims to compare the methods of SG and RYGB used in bariatric surgeries regarding early post-surgical complications, weight loss and regain, gender, age, and ethnicity, as well as management of diabetes, hypertension, and dyslipidemia. Previous review articles have only examined some of the topics discussed here, making a general decision-leading comparison of SG and RYGB difficult. By compiling the most recent evidence in a single article, we hope to make data interpretation and procedure selection easier.

METHODS

The present review followed PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) 2009 guidelines (12). Our study was not registered and did not require ethical approval because it was based on previously published patient data in the public domain. A literature search was conducted in Pubmed and Google Scholar from January 4th, 2022, to September 11th, 2022. The following search terms were used: "sleeve gastrectomy, long-term outcomes, sleeve, bypass, outcomes, comparison, bariatric surgery, weight loss." Five independent researchers participated in selecting and reviewing the article. The following inclusion criteria were used to select the articles: studies published since 2017 and if necessary relevant previous studies; written in Portuguese, English, or Spanish; with adults over the age of 18 years old; containing a comparative approach between Sleeve and Gastric Bypass bariatric surgeries in patients with BMI>35kg/m^2; and resulting in weight loss. The filters in the Pubmed platform were: "Adult: 19+ years" and "Humans." The following articles were excluded: non-human studies, nonrandomized studies, and studies on gastric banding. Five researchers independently reviewed the titles and abstracts of the articles selected, eliminating duplicated articles (Figure 3). At the end of the screening, 44 articles were chosen for complete text analysis. Next, all five researchers independently evaluated the full texts to apply the inclusion and exclusion criteria.

RESULTS

Patient information regarding sex, age, and ethnicity from each article analyzed was summarized in Table 1. The patient's average age was 41.6 years old. Bariatric surgeries were conducted predominantly in women (63.2%). In addition, women were the predominant sex undergoing bariatric

surgery in 23 of the articles examined, while men were the majority in only three articles, and the remaining articles did not specify.

Only four studies specified ethnicity. In the first, Hispanics accounted for 59.28%, Afro-Americans for 22.75%, and other ethnicities accounted for 17.4% (13). The second study looked only at the population of Western countries (21), the third at 81% whites (49), and the fourth at 80% white and 20% non-white (51).

Bariatric surgery reduced major obesity-related comorbidities (diabetes, hypertension, and dyslipidemia), improved weight loss, and had few post-surgical complications (Table 2). Several studies compared RYGB and SG without taking diabetes into account. Of those who did, 63% concluded that RYGB is more effective in diabetes remission, while 37% concluded that there was no significant difference. Only 28 studies investigated hypertension and observed that arterial blood pressure improved after bariatric surgery and that RYGB was more effective than SG in controlling blood pressure. Bariatric surgery significantly improved dyslipidemia in patients, with 17 studies demonstrating that RYGB outperformed SG in controlling dyslipidemia. However, in nine articles, there was no significant difference between the two procedures. Most studies (83.6%) found that RYGB resulted in more significant weight loss. Five articles concluded that SG is associated with greater weight gain. Four analyzed articles showed weight gain but no significant difference between the two groups. Furthermore, 20 articles (45%) concluded that RYGB has more early post-surgical complications, two articles (4.5%) concluded that SG has more early complications, two articles (4.5%) found no difference between the two procedures, and 20 articles (45.5%) did not analyze the early complication rate.

DISCUSSION

AGE

In the selected articles, the average age of patients undergoing bariatric surgery was 41.6 years. This overall mean result was already expected because Roux-en-Y and Sleeve surgery is mostly indicated for adults aged 18 to 60, and the mean age is around 40. Another factor that explains this average is that morbid obesity primarily affects people between the ages of 40 and 59 years old, and individuals in this age group tend to elect bariatric surgery (54). Morbid obesity has increased sharply in the young population since the introduction of smartphones, computers, tablets, and other electronic devices, as well as the popularization of fast food. The future trend is for younger patients with morbid obesity, so the average age will likely fall in the coming years.

SEX

The estimated number of adult women with obesity increased from 69 (57-83) million in 1975 to 390 (363-418) million in 2016, while the number of men with obesity increased from 31 (24-39) million in 1975 to 281 (257-307) million in 2016 (55). It is also predicted that by 2025, the global prevalence of obesity will reach 18% in men and 21% in women (56). As a result, the higher proportion of obese women compared to men is consistent with the higher number of bariatric surgeries performed in women, whether by Roux-en-Y gastric bypass or vertical gastrectomy. However, it is also important to consider the social issues that lead women to seek surgical interventions to lose weight. The current aesthetic standard of beauty is primarily represented by thinness and is constantly reinforced in social media, which may influence the growing number of women seeking bariatric surgery.

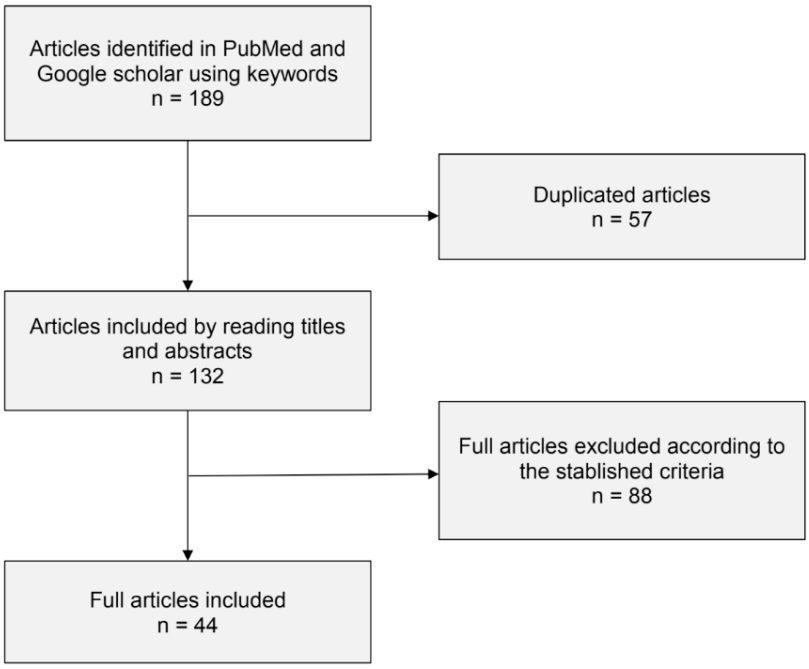

Figure 3. PRISM diagram.

Study type	Sex	Age	Ethnicity	Ref
Retrospective	Female (88.64%); Male (11.36%)	18-76	Hispanic (59.28%), African-American (22.75%), others (17.4%)	(13)
Retrospective	Female (68.8%), Male (31.2%)	Average 43.9	-	(14)
Meta-analysis and systematic review	-	>18	-	(15)
Retrospective	RYGB: Female (46.3%), Male (53.7%) SG: Female (60.0%), Male (40.0%)	18-65	-	(16)
Meta-analysis and systematic review	-	18-65	-	(17)
Randomized clinical trial	Female (72%), Male (28%)	18-65	-	(18)
Randomized clinical trial	-	18-60	-	(19)
Randomized clinical trial	Female (69,5%) Male (59,5%)	18-60	-	(19)
Meta-analysis and systematic review	-	18-60	-	(20)
Meta-analysis	-	-	Western countries	(21)
Systematic review	-	18-65	-	(22)
Meta-analysis	SG: Female (64,5%) Male (35,5%) RYGB: Female (68%) Male (32%)	Average 10.9-38.6	-	(23)
Meta-analysis and systematic review	-	-	-	(24)
Meta-analysis and systematic review	-	18-70	-	(25)

Meta-analysis and systematic review	More female	Average 34.6-60.6	-	(26)
Meta-analysis and systematic review	-	18-60	-	(27)
Randomized clinical trial	RYGB: Female (67,2%) Male (32,8%) SG: Female (71,9%) Male (28,1%)	18-60	-	(28)
Meta-analysis and systematic review	-	>18	-	(20)
Meta-analysis	-	-	-	(21)
Meta-analysis and systematic review	Female (70%), Male (30%)	Average 43.4	-	(29)
Systematic review	-	>18	-	(30)
Literature review	-	-	-	(31)
Randomized clinical trial	-	Average 48.4	-	(32)
Cohort	More female	Average 10.3-30.8	-	(33)
Meta-analysis and systematic review	More male	>18	-	(34)
Comparative	RYGB: Female (27/32), Male (5/32) SG: Female (10/11), Male (1/11)	Average 35	-	(35)
Meta-analysis and systematic review	-	-	-	(36)
Meta-analysis	-	-	-	(37)
Retrospective	-	Average 10.9-43.3	-	(38)
Meta-analysis and systematic review	More female	<65	-	(39)
Randomized clinical trial	Female (167/240), Male (73/240)	Average 48.5	-	(28)
Randomized clinical trial	More male	18-65	-	(40)
Review	-	-	-	(41)
Retrospective cohort	Female (53.7%), Male (46.3%)	42.8	-	(42)
Retrospective	RYGB: Female (80%), Male (20%) SG: Female (77.5%), Male (22.5%)	Average 44.5	-	(43)
Clinical study	Female (75%), Male (25%)	Average 42.3	-	(44)
Comparative	Female (78.3%), Male (21.7%)	>19	-	(45)
Meta-analysis	Female (79.4%), Male (20.6%)	Average 40.8	-	(46)
Comparative	Female (20%), Male (80%)	Average 46.7	-	(47)
Observational	Female (66.94%), Male (33.06%)	Average 49.7	-	(48)
Observational	Female (68%), Male (32%)	Average 49	White (81%)	(49)
Review	-	-	-	(50)
Comparative	Female (78.9%), Male (21.1%)	Average 45	White (80%), Non-white (20%)	(51)
Observational	Female (68.2%), Male (31.8%)	Average 48	-	(52)

Table 1. Patient profiles from the selected articles.

Abbreviations: Reference (Ref), Not analyzed (-), Roux-en-Y Gastric Bypass (RYGB), Gastric Sleeve/ Vertical Gastrectomy (SG).

Study type	Diabetes	Hypertension	Dyslipidemia	Weight loss	Weight gain	Early post-surgical complications	Ref
Retrospective	-	-	-	RYGB > SG	-	-	(13)
Retrospective	-	-	-	RYGB > SG in 1st year	-	RYGB > SG	(14)
Meta-analysis and systematic review	-	-	-	RYGB > SG	Yes	-	(15)
Retrospective	-	-	-	RYGB > SG	-	RYGB > SG	(16)
Meta-analysis and systematic review	-	-	-	RYGB > SG	-	-	(17)
Randomized clinical trial	Improved, RYGB > SG	Improved, RYGB > SG	Improved, SG > RYGB	RYGB > SG	-	RYGB > SG	(18)
Randomized clinical trial	Improved, RYGB > SG	Improved, RYGB > SG	Improved, SG > RYGB	RYGB > SG	-	RYGB > SG	(53)
Randomized clinical trial	-	-	Improved, SG > RYGB	RYGB > SG	-	-	(19)
Meta-analysis and systematic review	Improved, RYGB > SG	Improved, RYGB > SG	-	RYGB > SG	-	-	(27)
Meta-analysis	Improved, RYGB > SG	Improved, RYGB > SG	-	RYGB > SG	-	-	(21)
Systematic review	-	-	-	RYGB > SG	-	-	(22,30)
Meta-analysis	No improvement	Improved, RYGB > SG	-	RYGB > SG	-	RYGB had less post-operatory leakage and lower mortality	(23)
Meta-analysis and systematic review	-	-	-	-	-	-	(24)
Meta-analysis and systematic review	Faster improvement for RYGB, no difference after a longer period	Improved, RYGB > SG	No improvement	RYGB > SG	-	RYGB > SG	(25)
Meta-analysis and systematic review	-	-	-	-	-	-	(26)
Meta-analysis and systematic review	Improvement, RYGB = SG	Improved, RYGB > SG	-	RYGB = SG	-	RYGB > SG	(27)
Randomized clinical trial	-	-	-	RYGB > SG	-	RYGB > SG	(28)
Meta-analysis and systematic review	Improved, RYGB > SG	-	-	-	-	-	(20)
Meta-analysis	Improved, RYGB > SG	Improved, RYGB > SG	-	RYGB > SG	-	-	(29)
Meta-analysis and systematic review	No improvement	No improvement	-	RYGB > SG	-	-	(30)
Systematic review	-	Improved, RYGB > SG	-	RYGB > SG	-	Robotic surgery presented fewer post-operatory complications for both RYGB and SG	(31)
Literature review	Improved, RYGB > SG	Improved, RYGB > SG	-	-	-	-	(32,44)

Randomized clinical trial	No improvement	Improved, RYGB > SG	Improved, RYGB > SG	RYGB > SG	-	RYGB > SG	(45)
Cohort	Improved	-	-	-	SG > RYGB	RYGB > SG	(35)
Meta-analysis and systematic review	No improvement	-	-	RYGB > SG	SG > RYGB	RYGB > SG	(36)
Comparative	Improved, RYGB = SG	Improved, RYGB = SG	Improved, RYGB > SG	RYGB = SG	-	-	(37)
Meta-analysis and systematic review	Improved, RYGB > SG	-	No improvement	-	-	RYGB presented fewer complications than SG	(38)
Meta-analysis	Improved, RYGB = SG	-	-	RYGB > SG	-	RYGB > SG	(37)
Retrospective	-	Improved, RYGB = SG	-	RYGB > SG	-	RYGB > SG	(38)
Meta-analysis and systematic review	Improved, RYGB > SG	Improved, RYGB = SG	Improved, RYGB = SG	RYGB > SG	-	-	(39)
Randomized clinical trial	No improvement	Improved, RYGB > SG	Improved, RYGB = SG	RYGB > SG	-	RYGB > SG	(40)
Randomized clinical trial	-	-	-	RYGB > SG	-	RYGB > SG	(40)
Review	Improved, RYGB > SG	-	-	RYGB > SG	SG > RYGB	RYGB > SG	
Retrospective cohort	Improved, RYGB > SG	Improved, RYGB = SG	Improved, RYGB = SG	RYGB > SG	SG > RYGB	-	(42)
Manuscript	Improved, RYGB > SG	Improved, RYGB > SG	-	RYGB > SG	RYGB = SG	-	(43)
Clinical trial	Improved, RYGB > SG	Improved, RYGB > SG	Improved, RYGB > SG	RYGB > SG	SG<RYGB	RYGB > SG	(44)
Comparative	No improvement	Improved, RYGB > SG	-	RYGB > SG	SG<RYGB	-	(45)
Meta-analysis	-	Improved, RYGB = SG	-	RYGB > SG	-	-	(46)
Comparative	Improved, RYGB > SG	Improved, RYGB = SG	-	RYGB > SG	RYGB = SG	RYGB > SG	(47)
Observational	-	Improved, RYGB > SG	-	RYGB > SG	-	RYGB > SG	(49)
Observational	-	Improved, RYGB > SG	-	RYGB > SG	RYGB = SG	-	(49)
Review	Improved, RYGB > SG	Improved, RYGB > SG	-	RYGB > SG	-	RYGB > SG	(50)
Comparative	-	-	-	RYGB > SG	-	RYGB > SG	(51)
Observational	-	Improved, RYGB = SG	-	RYGB > SG	-	RYGB > SG	(52)

Table 2. Effects of bariatric surgery on patient's comorbidities, weight management, and complications

Abbreviations: Reference (Ref), Not analyzed (-), Roux-en-Y Gastric Bypass (RYGB), Gastric Sleeve/ Vertical Gastrectomy (SG).

ETHNICITY

Little information was available about the ethnic groups that had undergone the surgeries. This information would aid in determining whether there is a genetic predisposition to obesity or whether the performance of any surgeries depends solely on a country's or region's socioeconomic condition.

WEIGHT LOSS

According to the findings of this systematic review, RYGB results in greater weight loss. However, in this study, we only compared the number of articles that indicated that RYGB was a better method for weight loss, not the number of patients reported in each study or the number of kilograms lost with the surgical technique. In this regard, the question is whether a supposedly high rate of weight loss is sufficient evidence to favor one surgical technique over another.

SYSTEMIC HYPERTENSION

Systemic arterial hypertension is one of the most common comorbidities in the population, and many patients who undergo bariatric surgery hope to improve this comorbidity to some extent (57). According to data from the Pan-American Health Organization, hypertension is one of the leading causes of death and affects between 20% and 35% of the adult population in Latin America. The GATEWAY study aimed to assess the effect of bariatric surgery on hypertension control in obese patients (58). In this study, 100 obese people (BMI: 30.0-39.9 kg/m2) taking two or more hypertension medications were randomly assigned to one of two treatment groups: those who received bariatric surgery (gastric bypass) and hypertension medication, those who received only medical therapy. According to the findings, patients with obesity and hypertension who underwent gastric bypass plus drug therapy were more likely than patients treated with drug therapy alone to reduce the number of medications by 30% after a year. Notably, half of the patients in the surgical group were able to keep their blood pressure under 140/90 mmHg without needing medications, whereas no patients in the control group were medication-free at the end of the 12-month study. Thus, the main conclusion was that bariatric surgery could be an effective tool for controlling hypertension in obese patients, but multidisciplinary medical follow-up is necessary after bariatric surgery.

DIABETES

The rise in the global prevalence of obesity is a significant risk factor for diabetes onset. Several epidemiologic studies show a parallel rise in obesity and diabetes (59). Both metabolic disorders are linked by two pathophysiologic factors: insulin resistance and insulin deficiency, favoring adipose tissue accumulation. In addition, there has been an increase in research on metabolic defects common to both obesity and diabetes, such as impaired tissue perfusion, sleep disturbances, androgen dysfunction, altered Vitamin D levels, and GI stress, in recent years (59). Diabetes can be viewed as both a cause and a result of obesity, emphasizing its importance when discussing obesity (60). If bariatric surgery is indicated, RYGB is the most effective technique in patients whose primary goal of surgery is diabetes remission.

DYSLIPIDEMIA

Increased fasting plasma triglycerides, high LDL cholesterol, low HDL cholesterol, elevated blood glucose, insulin levels, and elevated arterial systemic pressure are all risk factors for cardiovascular disease exacerbated by obesity. Small dense LDL phenotype, postprandial hyperlipidemia with

an accumulation of atherogenic remnants, and hepatic overproduction of lipoproteins containing apoB are new lipid-dependent metabolic risk factors linked to obesity (61). A pro-inflammatory gradient linked to lipid abnormalities may originate in adipose tissue and directly affect the endothelium (61). A crucial connection between obesity, metabolic syndrome, and dyslipidemia appears to be the emergence of insulin resistance in peripheral tissues, which increases the hepatic flux of fatty acids (61). In patients with morbid obesity, bariatric surgery is the most effective method to produce more efficient and long-term weight loss and reduce dyslipidemia. For this purpose, RYGB was slightly superior in reducing dyslipidemia compared to SG.

EARLY POST-SURGICAL COMPLICATIONS

Gastric bypass has higher rates of early complications. The most common ones are anastomotic fistula (which can lead to peritonitis), hemorrhage, hernia, anastomotic stenosis, deep vein thrombosis, and pulmonary embolism (62). Furthermore, prolonged anesthesia increases the risk of severe neurological and cardiorespiratory problems. RYGB requires more anastomoses than SG, which may lead to more complications. In addition, the biliopancreatic tree and the duodenum are connected in the newly reduced stomach and the gastric pouch (11). This increases the likelihood of dehiscence and bleeding compared to sleeve surgery (11).

In gastric bypass, 5% of anastomotic fistulas are caused by ischemia, while 95% are caused by a technical error, such as using the wrong size staples, inefficient leak testing, or a lack of suture reinforcement. Peritonitis is characterized by infection-related symptoms such as abdominal pain and distension, fever, nausea, and vomiting (65). Suture dehiscence is another major complication of RYGB that is closely related to a technical error and is another cause of gastric content leakage. Other serious complications include intestinal bleeding, which can result in hematemesis, intestinal obstruction caused by hernias, and anastomotic stenosis. The last two can also cause acute obstructive abdomen in the medium to long term. Finally, the complications of vertical gastrectomy are acute pancreatitis with abdominal pain, nausea, vomiting, partial splenic infarction, and acute kidney injury. As a result, the immediate post-operative warning signs are pain, fever, and abdominal distension, which may indicate a surgical complication.

WEIGHT GAIN

The articles reviewed show that SG surgery may be associated with greater post-surgery weight gain compared to RYGB. After a certain period, some patients underwent SG revisional surgery because of inadequate weight loss or weight gain (63). Despite being the most successful and long-lasting surgical treatment for obesity, about 20% to 25% of patients gain significant weight after having bariatric surgery. Although some authors link behavioral and biological mechanisms to weight gain, it is still unclear what preoperative factors may cause weight gain. Therefore, counseling about the potential for weight gain and psychological follow-up is the best practices for making behavioral changes regarding food intake and physical activity.

LIMITATIONS

Numerous articles provided contradictory information about the operations' outcomes, and many ignored the impact of those outcomes on the patient's comorbidities. These information gaps may interfere with the percentages used in the conclusions. However, since most articles provided information about the comorbidities, we believe our conclusions

were accurate.

Additionally, most studies were conducted in the United States, Europe, and China, with large populations and excellent medical resources. However, developing countries with large populations, such as India and countries like Brazil, also have high levels of obesity, and access to bariatric surgeries is very limited to the low-income population. As a result, the type of surgery performed in each location may be influenced by financial and medical resources.

Furthermore, the literature lacks information about certain patient groups, such as postmenopausal women and adolescents who wish to undergo this procedure. This information would help determine the best type of surgery for these specific profiles.

CONCLUSION

Overall, RYGB and SG techniques facilitate weight loss and reduce risks of obesity-related comorbidities in patients with BMI>40 kg/m^2. Despite having more post-surgical complications, RYGB resulted in more weight loss and prevented later weight gain. Furthermore, RYGB more effectively controls hypertension, diabetes, and dyslipidemia, making it an ideal surgery for patients with severe comorbidities. Conversely, SG had fewer post-surgical complications, which may benefit patients with other concurrent diseases. However, SG may worsen pre-existing GERD in some patients. Obesity is frequently associated with GERD due to increased intra-abdominal pressure, which causes an increase in the gastroesophageal pressure gradient (64). As a result, the most recommended approach is to evaluate whether the surgical risks of each procedure outweigh the long-term benefits obtained by patients.

In conclusion, this review effectively analyzed the foremost parameters to be considered when choosing between SG and RYGB and facilitated the joint interpretation of both in the resolution of comorbidities and improvement in quality of life. This is justified not only by using the most recent articles on the subject but also by the study's level of detail, as no scientific articles in the current literature provide such a broad and comprehensive comparison of the subject.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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