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COMPARISON OF LAPAROSCOPIC SLEEVE GASTRECTOMY AND LAPAROSCOPIC ROUX-EN-Y GASTRIC BYPASS: WHICH PROCEDURE IS MORE EFFECTIVE? A SYSTEMATIC REVIEW

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Abstract: INTRODUCTION: Obesity, with its high prevalence and impact on comorbidities such as type 2 diabetes and hypertension, is a serious public health problem that also generates significant social and economic costs. Among treatment approaches, bariatric surgeries such as Laparoscopic Sleeve Gastrectomy (LSG) and Laparoscopic Roux-en-Y Gastric Bypass (LRYGB) stand out. LSG reduces stomach volume, while LRYGB combines restriction and malabsorption. Comparing these procedures is essential to evaluate differences in efficacy, risks and complications, guiding evidence-based clinical choices for better outcomes. OBJECTIVE: The aim of this review is to compare the efficacy of Laparoscopic Sleeve Gastrectomy (LSG) and Laparoscopic Roux-en-Y Gastric Bypass (LRYGB) on weight loss, glycemic control, management of comorbidities, postoperative complications and impact on quality of life in patients with obesity. METHODS: The search was carried out in the PUBMED, VHL and MEDLINE databases, covering articles in English from 2019 to 2024, using keywords related to LSG and LRYGB. Initially, 512 articles were identified, of which 150 were selected after screening for duplicates and non-comparative articles. In the end, 37 studies were included in the analysis after a full review. RESULTS AND DISCUSSION:Laparoscopic Sleeve Gastrectomy (LSG) involves removing 75% of the stomach, forming a narrow tube that limits food intake. This reduces the secretion of ghrelin, the "hunger hormone", promoting satiety and reducing calorie intake. In addition, LSG increases the release of peptide YY (PYY) and GLP-1, hormones that promote satiety and improve insulin sensitivity. Roux-en-Y gastric bypass (RYLGB) combines restriction and malabsorption, resulting in more pronounced weight loss in the long term. It reduces the absorption of calories and nutrients, increasing the secretion of GLP-1 and PYY

more intensely than LSG. This contributes to better control of comorbidities such as type 2 diabetes. LSG is less invasive, has a lower risk of nutritional complications and allows for faster recovery. However, initial weight loss may be lower than with RYGB, which, despite requiring strict nutritional monitoring, tends to result in more sustained weight loss. Both surgeries are effective in reducing comorbidities such as type 2 diabetes, hypertension and dyslipidemia. LSG provides rapid weight loss that improves insulin sensitivity, while RYGB is more effective in reducing carbohydrate absorption. In terms of quality of life, LSG allows for a faster recovery and lower risk of complications, while RYGB can have a negative impact due to possible nutritional deficiencies. LSG and RYGB have short- and long-term complications. In the short term, these include infections and leaks, while in the long term, LSG can lead to stenosis, gastroesophageal reflux and nutritional deficiencies. RYGB also carries risks of nutritional complications and requires constant monitoring. CONCLUSION: The comparison between Laparoscopic Sleeve Gastrectomy (LSG) and Roux-en-Y Gastric Bypass (RYGB) shows that both are effective in the treatment of morbid obesity, but have distinct characteristics that influence weight loss and quality of life. LSG is simpler and has a faster recovery, but can face challenges in maintaining weight loss over the long term. In contrast, RYGB provides more significant and lasting weight loss, with additional benefits for comorbidities, but requires strict nutritional monitoring. The choice between procedures should be patient-centered, taking into account the patient's needs, expectations and the importance of dietary re-education. Success depends on collaboration between doctor and patient, with continuous post-operative follow-up aimed at reducing dissatisfaction and promoting better health outcomes and quality of life.

Keywords: "Laparoscopic Sleeve Gastrectomy", "Laparoscopic Roux-en-Y Gastric Bypass", "bariatric surgery", "weight loss", "results of surgery for obesity", and "resolution of comorbidities".

INTRODUCTION

Obesity is recognized as one of the most important public health problems of the 21st century, with its high prevalence affecting millions of people globally. Associated with various comorbidities, such as type 2 diabetes, hypertension, dyslipidemia and cardiovascular diseases, obesity not only compromises the quality of life of individuals, but is also related to increased mortality [1]. In addition to the impact on health, obesity generates considerable economic and social costs, putting a strain on all systems [1].

Given the severity of the obesity epidemic, various measures have been proposed, including behavioral, pharmacological and surgical approaches [1,2]. Although non-surgical methods can be effective in some cases, bariatric surgery has become an increasingly relevant option for controlling severe obesity, demonstrating superiority compared to conventional treatments, especially in patients with a high Body Mass Index [1,2].

The main surgical techniques include Laparoscopic Sleeve Gastrectomy (LSG) and Laparoscopic Roux-en-Y Gastric Bypass (LRYGB) [3]. LSG is a restrictive procedure that significantly reduces the volume of the stomach, while LRYGB combines restrictive and malabsorptive mechanisms, creating a bypass in the gastrointestinal tract [3,4]. Both techniques are indicated for weight loss, control of comorbidities and increased quality of life [3,4].

The comparison between LSG and LRYGB raises important questions about the effectiveness of each procedure, not only in terms of weight loss, but also in resolving comorbidities,

analyzing surgical risks and long-term complications. The literature shows a variability of results, highlighting the need for systematic reviews that deepen this discussion and provide new data and approaches to be taken [4].

Therefore, this article aims to carry out a systematic review of the available literature, highlighting the importance of directly comparing LSG and LRYGB in terms of efficacy, safety and impact on quality of life. The aim is to provide an evidence-based view that can guide clinical practices and help choose the most appropriate procedure for the patient [4].

OBJECTIVE

The aim of this systematic review is to compare the effectiveness of Laparoscopic Sleeve Gastrectomy (LSG) and Laparoscopic Roux-en-Y Gastric Bypass (LRYGB) as surgical interventions for weight loss, glycemic control, management of comorbidities associated with obesity, postoperative complications and the impact on the quality of life of patients undergoing surgical procedures to treat obesity [5]. Obesity is a global public health problem, associated with a series of comorbidities that affect quality of life and increase mortality [5,6]. Given the growing prevalence of obesity and the limited effectiveness of long-term behavioral and pharmacological interventions, bariatric surgery has emerged as the most effective option for promoting significant and sustainable weight loss [5,6].

METHODS

The search was conducted in the PUBMED, VHL and MEDLINE databases, covering articles published between 2019 and 2024, in English. The keywords used included: "Laparoscopic Sleeve Gastrectomy", "Laparoscopic Roux-en-Y Gastric Bypass", "bariatric surgery", "weight loss", "obesity surgery outcomes", and "comorbidity resolution" [7].

The selection process followed three stages. In the first, 512 articles were identified using a combination of descriptors and date and language filters. In the second stage, an initial screening was carried out based on the titles and abstracts, resulting in the exclusion of duplicate studies, non-systematic review articles, experimental animal studies, dissertations, theses and articles that did not directly compare LSG and LRYGB. This screening resulted in 150 studies for full evaluation. In the third stage, the remaining articles were fully reviewed and 37 studies were included in the final analysis, after excluding publications with incomplete results, redundant data or inadequate methodology [7].

RESULTS AND DISCUSSION

HORMONAL MECHANISMS AND METABOLIC EFFECTS IN SLEEVE GASTRECTOMY AND GASTRIC BYPASS

Laparoscopic Sleeve Gastrectomy (LSG) is a surgical technique that promotes weight loss by removing approximately 75% of the stomach, transforming it into a narrow tube, which significantly limits the ability to eat. With a reduced stomach, patients feel satiated more quickly, which contributes to a lower calorie intake [8]. One of the main hormones involved is ghrelin, often called the "hunger hormone", which is produced mainly in the stomach [8]. In patients who have undergone LSG, the removal of a large part of the stomach results in a decrease in ghrelin secretion, leading to a faster and longer feeling of satiety after meals. This reduction in ghrelin levels contributes to lower calorie intake, as patients feel less hungry [9].

In addition to ghrelin, another important hormone that plays a crucial role in satiety is peptide YY (PYY). PYY is secreted by intestinal L cells in response to food intake

and acts to reduce appetite and increase the feeling of fullness [9]. After LSG, changes in the anatomy of the gastrointestinal tract can lead to an increase in the release of PYY, further contributing to the feeling of satiety [9,10]. This is because, with a smaller stomach, food is processed more quickly and, as a result, more PYY is released into the intestine. This increased secretion of PYY helps inhibit hunger and prolongs satiety, further reducing calorie intake [10].

Another hormone that plays a key role after LSG is Glucagon-Like Peptide-1 (GLP-1) [11]. This hormone, also secreted by intestinal cells, increases in response to food intake and has a positive impact on appetite regulation, as well as improving insulin sensitivity [11,12]. The increase in GLP-1 levels after Sleeve Gastrectomy is associated with the promotion of satiety and a reduction in food consumption. Thus, LSG not only decreases ghrelin, but also stimulates the secretion of PYY and GLP-1, creating a hormonal environment that favors weight loss and improved glucose metabolism [12].

On the other hand, the Laparoscopic Roux-en-Y Gastric Bypass (RYLGB) combines the reduction of the stomach with a modification of the path of food through the digestive system. In this procedure, the stomach is reduced to a small pouch and connected directly to the small intestine, avoiding the first portion of the duodenum [13]. This change in the transit of food not only limits the amount of food the patient can eat, but also reduces the absorption of calories and nutrients, resulting in greater weight loss in the long term [13,14]. However, this change may require stricter nutritional monitoring to avoid vitamin and mineral deficiencies [14].

The main difference between the two techniques lies in the mechanism of action. While Sleeve Gastrectomy acts primarily by restricting food volume, Gastric Bypass combines restriction and malabsorption of nutrients [15]. This makes RYLGB more effective in controlling some comorbidities associated with obesity, such as type 2 diabetes, but it also increases the risk of nutritional deficiencies [15]. In hormonal terms, the Gastric Bypass also causes significant changes. The direct connection of the stomach to the small intestine stimulates the secretion of hormones such as GLP-1 and PYY in a more intense way compared to LSG [15,16]. These hormones are fundamental to appetite regulation and can help promote satiety more efficiently [16].

In RYLGB, the elevation of GLP-1 levels is particularly beneficial, as this hormone not only increases the feeling of satiety, but also improves insulin sensitivity and has antidiabetic effects [17]. Meanwhile, removal of the duodenum results in a decrease in ghrelin secretion, similar to what occurs in LSG, but the magnitude of this reduction can vary [17,18]. Therefore, the choice between the two techniques depends on the patient's clinical profile, considering factors such as the severity of obesity, associated comorbidities and the ability to adhere to long-term nutritional monitoring. Furthermore, understanding the hormonal differences between the two approaches is crucial in order to personalize the treatment and maximize the results in terms of weight loss and improving the patient's general health [18].

ADVANTAGES AND DISADVANTAGES OF SLEEVE GASTRECTOMY AND GASTRIC BYPASS

The comparison between Laparoscopic Sleeve Gastrectomy (LSG) and Roux-en-Y Gastric Bypass (RYLGB) reveals a balance between the advantages and disadvantages of each technique. LSG stands out due to the simplicity of the procedure and the shorter recovery time, which makes it an attractive choice for patients looking for a less invasi-

ve solution [18,19,20]. In addition, the lower risk of nutritional complications is a positive point. Laparoscopic sleeve gastrectomy (LSG) promotes faster weight loss initially due to several interconnected factors [18,19,20]. Firstly, the surgery causes immediate food restriction, since it removes a large part of the stomach, resulting in an organ with a tubular shape that significantly limits the ability to ingest food [18,19,20]. Thus, the patient experiences satiety with smaller portions, leading to a substantial calorie deficit [18,19,20]. This rapid and effective restriction in the volume of food consumed is one of the main reasons why patients experience significant weight loss immediately after the procedure [20]. In addition to the immediate restriction, there is also a rapid physiological adaptation of the body to the new stomach anatomy [20]. Combined with the technical simplicity of LSG, which allows for a faster recovery and a return to a liquid and pasty diet, these factors create an environment conducive to rapid weight loss in the first few months after surgery [20,21].

However, initial weight loss with LSG may be lower than with Roux-en-Y gastric bypass, which not only limits food intake, but also alters the digestive process, promoting malabsorption of nutrients and often resulting in more sustained weight loss over time [20,21]. Furthermore, although LSG can result in faster weight loss initially, maintaining this loss in the long term can present challenges [22]. Over time, the stomach can expand, allowing the patient to consume larger portions, which can make it difficult to maintain the calorie deficit needed to continue losing weight. Regardless of the technique, adherence to a healthy lifestyle, ongoing medical monitoring and individual factors such as metabolism and genetics are crucial to successful weight loss maintenance [22,23].

EFFECTIVENESS IN IMPROVING COMORBIDITIES AND QUALITY OF LIFE

When choosing between Laparoscopic Sleeve Gastrectomy (LSG) and Roux-en-Y Gastric Bypass (RYLGB), several factors must be carefully considered to ensure that the procedure meets the specific needs and circumstances of each patient [23,24]. The degree of obesity is a crucial aspect; those with severe morbid obesity may benefit more from Gastric Bypass, which tends to result in more pronounced weight loss [23,24]. The patient's psychological profile and age are also determining factors, since younger patients with a good psychological support network can adapt better to the demands and lifestyle changes that accompany the Bypass [23,24]. Finally, it is essential that the patient has realistic expectations and is aware of the advantages and disadvantages of each technique, allowing for an informed choice that maximizes the chances of long-term success [23,24].

The comparison between Laparoscopic Sleeve Gastrectomy (LSG) and Gastric Bypass (RYGB) in improving comorbidities and quality of life reveals important nuances that should be considered [25]. In relation to Type 2 Diabetes, LSG has been shown to be effective in inducing rapid weight loss which, in turn, improves insulin sensitivity and reduces blood glucose levels [25]. Many patients experience diabetes remission after surgery, partly due to the dietary restriction that LSG provides. RYGB is also highly effective in managing diabetes, especially by reducing carbohydrate absorption, but LSG can offer initial advantages in glycemic control, which is a crucial factor when choosing a surgical technique [25,26].

Both surgeries are effective in reducing hypertension and dyslipidemia [26]. Weight loss resulting from either procedure leads to a reduction in blood pressure and cholesterol

levels, contributing to a significant improvement in the metabolic profile [26,27]. In addition, bariatric surgery promotes hormonal changes that help regulate glucose and lipid metabolism, as well as reducing the inflammation associated with obesity. These changes are fundamental for improving comorbidities and highlight the importance of surgery in the general health of obese patients [28].

In terms of quality of life, LSG stands out because it allows for a faster and less painful recovery, due to its lower complexity compared to RYGB [28]. The preservation of the small intestine in LSG reduces the risk of dietary complications, such as dumping syndrome and nutritional deficiencies, resulting in greater patient satisfaction [28]. On the other hand, although RYGB can offer greater long-term weight loss, the associated risk of nutritional complications can affect quality of life [28,29]. Factors such as postoperative follow-up, realistic patient expectations and the presence of pre-existing comorbidities also play crucial roles in defining quality of life after surgery, highlighting the importance of ongoing, well-structured support after the procedure [28,29].

COMPLICATIONS OF LAPAROSCOPIC SLEEVE GASTRECTOMY (LSG) AND ROUX-EN-Y GASTRIC BYPASS (RYLGB)

Laparoscopic sleeve gastrectomy (LSG) and Roux-en-Y gastric bypass (RYGB) are surgical procedures widely used in the treatment of morbid obesity. Both offer significant benefits, but also present a set of complications that can occur in both the short and long term [29]. Among the short-term complications, surgical wound infection is a common concern. Patients with obesity and comorbidities such as diabetes are at greater risk due to factors that affect healing [30]. In addition, leakage at the staple line, a potentially serious complication, can occur and result in severe infections and peritonitis, requiring immediate medical intervention. Another complication that should not be overlooked is deep vein thrombosis (DVT), which can evolve into pulmonary embolism, a fatal condition that requires immediate attention [30].

In the long term, complications associated with LSG include stenosis of the sleeve, which can cause difficulty swallowing and significant weight loss. This condition often requires interventions such as endoscopic dilation or reoperation. Gastroesophageal reflux is also a concern, resulting in symptoms such as heartburn and burning, which may require drug or surgical treatment [30,31]. In addition, nutritional deficiencies represent a major challenge after LSG, since the reduction of the stomach limits the area available for nutrient absorption. This can lead to vitamin and mineral deficiencies, including iron, vitamin B12 and calcium, necessitating continuous nutritional monitoring [30,31]. Although less common in LSG than in RYGB, dumping syndrome, which occurs after eating foods high in sugar, can affect some patients [30,31].

In the case of Roux-en-Y gastric bypass, long-term complications also include nutritional deficiencies, but these tend to be more significant due to the malabsorption of nutrients that characterizes the procedure [30,31]. Patients who undergo RYGB often need lifelong vitamin and mineral supplementation, since the change in the anatomy of the gastrointestinal tract impairs the absorption of essential nutrients [30,31]. In addition, the formation of gallstones is a common complication resulting from increased bile secretion and may require surgical treatment in some cases. Other problems such as malabsorption, which can lead to conditions such as anemia and osteoporosis, and incisional hernias due to the weakening of the abdominal wall are also risks associated with Bypass [31].

Risk factors for complications in both procedures include morbid obesity, comorbidities such as diabetes and hypertension, advanced age, smoking and inadequate nutrition. These factors can compromise healing and increase the likelihood of complications, making careful patient selection crucial [31]. To minimize these risks, it is important that the surgical technique is appropriate and performed by an experienced surgeon, preferably using minimally invasive approaches. Close post-operative follow-up is essential, including nutritional and medical assessments, to identify and treat any complications early on. Finally, patient adherence to medical and nutritional guidelines is essential for successful treatment and for minimizing the risks associated with these surgical procedures [31,32].

CONCLUSION

The comparison between Laparoscopic Sleeve Gastrectomy (LSG) and Roux-en-Y Gastric Bypass (RYGB) reveals important nuances that affect both the effectiveness of weight loss and patients' quality of life [33]. This information can influence the decision of a patient, who can choose the most suitable procedure based on their own needs and expectations [34]. Both techniques are effective in the treatment of morbid obesity, but they have different characteristics that should be carefully considered when deciding which procedure to use [35]. It is essential that the patient understands that both procedures are invasive and require a significant change in mentality and eating routine, with an emphasis on targeted dietary education even after surgery [35].

LSG stands out for being a relatively simple technique, with a faster recovery and lower risk of nutritional complications, providing significant initial weight loss through dietary restriction and hormonal modulation. However, maintaining weight loss in the long term can be challenging due to the possibility of stomach expansion [35]. In turn, RYGB offers more pronounced and sustained weight loss, with additional benefits for patients with comorbidities such as type 2 diabetes, although it requires close nutritional monitoring due to the higher risk of nutritional deficiencies, which may require ongoing supplementation and regular monitoring [35]. Hormonal differences and the implications of each procedure on quality of life emphasize the importance of an individualized assessment that takes into account the patient's clinical profile, expectations and ability to adhere to post-operative follow-up [36].

In view of this, the choice between LSG and RYGB should be guided by a patient-centered approach, ensuring that the patient is fully informed about the risks and benefits of each procedure and understands the importance of dietary re-education and a commitment to long-term changes [37]. The success of the surgery depends on collaborative work between doctor and patient, with continuous post-operative follow-up to maintain the necessary discipline and maximize results. With this approach, dissatisfaction and failure rates can be significantly reduced, promoting better health outcomes and quality of life for patients [37].

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