GASTROESOPHAGEAL REFLUX DISEASE AND BARIATRIC SURGERY – CAN WE STANDARDIZE THE CHOICE OF PROCEDURE?

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Abstract

The obesity pandemic is becoming one of the most significant global problems. Along with obesity, gastroesophageal reflux disease (GERD) is becoming the most prevalent digestive problem. The relationship between these two conditions has been proven - obesity directly affects the development of GERD, as well as an increase in the incidence of GERD complications. A particular problem arises in patients who are candidates for bariatric surgery and have proven GERD, which can result in postoperative reflux. This review aims to highlight the interaction between these two conditions and present the results of bariatric surgery in the context of evaluating reflux disease before and after the bariatric procedure.

Keywords: obesity, gastroesophageal reflux disease (GERD), bariatric surgery

Introduction

Obesity is a global health problem of pandemic proportions, with a constant increase in incidence and significant negative effects on health, as well as socio-economic consequences. It is estimated that 13% of the world's adult population is obese. About 650 million people, that is, 340 million children and adolescents, are overweight or obese[1]. Previous efforts to tackle obesity, starting with prevention, through educational measures and nutritional attempts at treatment, have largely remained unsuccessful, as evidenced by the increasing incidence of this disorder. Therapeutic measures in the battle against obesity can be divided into several segments. The first segment is nutritional intervention, which should usually be accompanied by psychological support. Today, we have effective new-generation pharmacotherapies, primarily in the form of GLP-1 (Glucagon-like Peptide-1) agonists, which are slowly finding their place in the treatment of obesity in an increasing number of patients[2, 3]. However, so far, the only real and effective measure in the treatment of severe obesity in a strictly defined category of patients is bariatric surgery. Although the beginnings of this surgery are associated with the second half of the last century, it achieved true affirmation through the development of minimally invasive surgery[4]. After the first minimally invasive Roux-en-Y gastric bypass procedure (RYGBP) in 1994, there was a sudden increase in the number of these procedures with excellent results, both in terms of weight loss reduction and resolution of obesity comorbidities, primarily type 2 diabetes[5]. Another significant moment is the introduction of sleeve gastrectomy (SG), initially as a bridging procedure in the performance of duodenal switch surgery[6]. As this procedure is effective in the definitive treatment of overweight and obesity comorbidities, it has been included in special procedures for the treatment of obesity since 2011[7]. Due to its technical simplicity and excellent primary effects, SG has become by far the most common bariatric procedure today, with a total prevalence of over 55% of all bariatric procedures[8].

The epidemiology of gastroesophageal reflux disease (GERD) is closely linked to the pandemic prevalence of obesity. Today, GERD is the most common digestive tract disease. By definition, GERD is present when gastric contents reflux into the esophagus, causing concerning symptoms and/or complications. It is estimated that about 20% of adults in the United States and Europe have GERD symptoms at least once a month[9].

The causal connection between GERD and obesity is direct and clear and is explained by several different mechanisms[10, 11]. The first one is the direct increase in intra-abdominal and then intragastric pressure in obese individuals, resulting in an increased pressure gradient between the stomach and esophagus and, therefore, an increased possibility of gastroesophageal reflux[12]. Obese individuals often consume large quantities of food in a short period, leading to an increase in the frequency of transient lower esophageal sphincter relaxation (TLESR) or transient lower esophageal sphincter (LES) shortening[13]. In addition, obese individuals are more likely to have a hiatus hernia (HH) and

a discreet displacement of the LES, verified by high-resolution manometry.

The second negative effect of obesity on GERD is explained by the presence of metabolic syndrome, primarily in individuals with visceral obesity. Visceral obesity is an independent risk factor for the development of Barrett's esophagus (BE), one of the most severe complications of GERD. Furthermore, obesity, particularly in males, is an independent risk factor for the progression of BE to adenocarcinoma of the esophagus, a tumor with the highest increase in incidence among all solid tumors[14].

This review aims to highlight the basic dilemmas that a bariatric surgeon may encounter in patients with GERD. Through a systematic review of the literature, the effects of the most common bariatric procedures on GERD will be presented, and an algorithm for the proper approach to patients with obesity and GERD will be established.

Prevalence of GERD in obese patients

Patients with obesity more frequently experience symptoms of GERD, as well as complications of this condition. The frequency of GERD symptoms increases 1.2-3 times in patients who are overweight or obese. In a study by El Saraga et al.[15] that examined the correlation between body mass index (BMI) and GERD symptoms, the presence of GERD symptoms was verified in 23% of participants in the group with BMI < 25, 27% in the group with BMI 25-30 kg/m^2, and 50% in the group of participants with BMI > 30 kg/m^2. In the same study, the prevalence of erosive esophagitis distributed across different groups based on BMI (< 25, 25-30, > 30) was 12.5%, 29.8%, and 26.6%. In a study by Li et al. that included 3,000 participants, a significantly higher frequency of erosive esophagitis was verified in patients with obesity compared to those with normal body weight, with an odds ratio (OR) for the development of erosive esophagitis 3.3 times higher in obese individuals[16].

The presence of Barrett's esophagus (BE) can be particularly relevant in the choice of bariatric procedure. According to the latest clinical guidelines based on the evaluation of expert consensus group conclusions, BE represents a contraindication for performing sleeve gastrectomy. Of course, performing upper gastrointestinal endoscopy is necessary before deciding on the type of bariatric procedure[17].

It is interesting that, despite the indication that obesity increases the risk of developing symptoms of GERD and erosive esophagitis, studies examining the correlation between obesity and BE provide contradictory conclusions. Stein et al. demonstrated that every 5-unit increase in BMI is associated with a 35% increased risk of developing BE[18]. The study by Corley et al. did not indicate a direct relationship between BMI and BE but did show a positive correlation between increasing waist circumference and the development of erosive esophagitis and BE[19].

On the other hand, a meta-analysis conducted by Quamseya and colleagues, which included 13,434 patients who underwent preoperative upper gastrointestinal endoscopy, showed that the frequency of Barrett's esophagus (BE) was only 0.9%[20]. Although this study indicated a relatively low incidence of BE, a direct correlation between BMI increase and the development of BE was proven. Another study that included 240 subjects who underwent preoperative upper gastrointestinal endoscopy showed a prevalence of BE of 7.4%, and the presence of hiatal hernia and erosive esophagitis in 25.8% and 20.8% of subjects, respectively[21].

Although contradictory, these data still emphasize the importance of adequate upper gastrointestinal endoscopy and mandatory evaluation of the presence of hiatal hernia, erosive esophagitis, and BE in patients who are candidates for bariatric surgery. For example, a meta-analysis by Bennett and colleagues showed that based on preoperative endoscopy findings, the choice of bariatric procedure was changed in as many as 7.4% of patients[22]. The study included high-volume centers with identical or similar indications for the choice of bariatric procedure. Carbotti and colleagues compared the GERD symptom score of patients in preparation for bariatric surgery with endoscopic findings[23] and found an identical prevalence of erosive esophagitis in symptomatic and asymptomatic patients. Also, 87% of endoscopic findings of erosive esophagitis would be missed if preoperative endoscopy were performed only in patients with GERD symptoms. Chen and colleagues found in a retrospective analysis of endoscopic findings before bariatric surgery that the frequency of hiatal hernia was 43.1%, which significantly affected the choice of bariatric procedure[24].

The effects of bariatric procedures on GERD

Sleeve gastrectomy is currently the most commonly performed bariatric procedure[8, 17]. Its effects on weight loss and comorbidity resolution are excellent and long-lasting. However, the incidence of GERD and its complications after sleeve gastrectomy is concerning.

There are several explanations as to how sleeve gastrectomy can worsen pre-existing GERD or lead to *de novo* gastroesophageal reflux. Firstly, it should be noted that intragastric pressure in the stomach increases significantly after its constriction, which itself increases the pressure gradient between the stomach and the esophagus. Basal pressure in the stomach after sleeve gastrectomy is 18-19 mmHg, and after fluid intake, the pressure can rise to as much as 45 mmHg. Secondly, the very nature of the surgery involves, to a greater or lesser extent, disruption of the normal anatomy of the *Angle of His* and the *LESP sling fibers*. Additionally, if the surgeon creates an excessive narrowing of the stomach at the level of the *angular incisure*, a pooling of contents in the corpus occurs, with elevated pressure in the corpus and

potentially residual fundus, further exacerbating gastroesophageal reflux[17].

The shape of the stomach after sleeve gastrectomy (SG) may play a significant role in the development of postoperative gastroesophageal reflux disease (GERD). Verkin and colleagues conducted a radiological study in which they identified three different shapes of the stomach after SG: a uniform tubular shape, a wider corpus pouch, and a wider antral pouch[25]. The authors concluded that the SG shape with a wider antral pouch is more favorable for patients in terms of a lower incidence of reflux, which they attributed to the antrum's capacity for food storage and preserved propulsive function, resulting in less retrograde flow of contents in the stomach.

Furthermore, the width of the gastric pouch after SG is likely to affect the occurrence of postoperative reflux. In a retrospective study of 120 patients who underwent SG using bougies of 42 Fr and 32 Fr, patients who had a narrower sleeve had a higher incidence of postoperative reflux. This can be explained by Laplace's law, which states that the narrower the sleeve, the lower the compliance of the stomach and the higher the intragastric pressure. Therefore, considering the above, the "ideal sleeve" should be made around a wider bougie (recommended 42 Fr), avoiding stenosis at the level of the angular incisure, preserving antral function, and avoiding resection of this part of the stomach at least 4-5 cm from the level of the pylorus[17].

The effects of sleeve gastrectomy (SG) on postoperative gastroesophageal reflux disease (GERD) according to the literature are contradictory. Numerous studies show that there is a worsening of existing GERD, as well as the emergence of de novo reflux in a large percentage of patients.

Viscido and colleagues conducted a study on 253 patients which they followed for 18 months after SG, performing a control upper digestive tract endoscopy and an objective GERD symptom questionnaire[26]. The authors found that the frequency of GERD symptoms increased from 33% of patients preoperatively to 44% after 18 months. Reflux esophagitis grade A, according to LA classification, was verified in 20.1% of patients preoperatively and in 33.9% postoperatively, while the incidence of hiatal hernia increased from 22% to 34%. Endoscopic findings in symptomatic patients indicated the presence of erosive esophagitis in 65% of patients and hiatal hernia in 23%. De novo GERD symptoms were verified in 36.9% of patients.

On the other hand, numerous studies have shown a positive effect of SG on postoperative GERD. Rebecchi and colleagues conducted a prospective study on 71 patients, with a follow-up period of two years[27]. The authors divided patients into two groups, group A consisting of patients who had preoperatively verified pathological GERD, and group B consisting of patients who were negative for GERD. In group A, the postoperative GERD symptom score was significantly reduced, from 53.1 ± 10.5 to 13.1 ± 3.5. Also, the DeMeester composite pH metric score was reduced from 39.5 ± 16.5 to 10.6 ± 5.8. De novo pathological GERD was verified in 5.6% of patients in group B. Studies that have shown a positive effect of SG on improving reflux explain it by reducing body weight and intra-abdominal pressure, reducing food intake, and especially the absence of nighttime overeating.

There are contradictory data regarding concomitant hiatal hernia (HH) repair during sleeve gastrectomy (SG). The rationale for this procedure is to reduce HH, if present, with the restoration of the crural component of the lower esophageal sphincter (LES). For example, Gibson et al. showed that the incidence of GERD was reduced from 45% preoperatively to 6% with crural repair in approximately 55% of patients[28]. Similar results were reported by Daes et al[29]. In their study, with crural repair in approximately 30% of patients, the postoperative incidence of GERD was 5.6% during a one-year follow-up period. According to the latest clinical guidelines for SG, the vast majority of experts recommend careful identification of HH before SG and concomitant crural repair with SG if a hernia is present.

In conclusion, SG carries a significant risk of postoperative GERD or worsening of pre-existing reflux disease. The emphasis should be on preoperative identification of pathological GERD and adjusting the surgical technique to minimize the risk of postoperative reflux. Only in this way can a positive effect of SG on GERD be expected.

Roux-en-Y gastric bypass (RYGBP) is a bariatric procedure that combines a restrictive and malabsorptive mechanism for weight loss and achieving positive metabolic effects. In terms of GERD, this procedure may have a favorable effect, even a therapeutic one. The positive effects of RYGBP on GERD are due to reduced acid production in the gastric pouch and complete diversion of bile, practically eliminating the possibility of biliary reflux. During the procedure, the region of the Angle of His remains intact, and thus the function of the LES. Unlike SG, there is no increased pressure in the gastric pouch after RYGBP, and there is also no disturbance of esophageal motility[30].

Because of these positive effects on gastroesophageal reflux, RYGBP has been proposed as the primary antireflux procedure in obese patients. It is recommended that for patients with a BMI over 35 who require anti-reflux surgery, RYGBP should be considered as the primary procedure. Madalosso and colleagues showed that in obese patients with preoperatively confirmed GERD, RYGBP resulted in the resolution of reflux symptoms (58% preoperatively, 9% postoperatively), reflux esophagitis (45% preoperatively, 19% postoperatively), and DeMeester's pH score (from 28.2 to 1.2 three years after surgery)[31]. In the study by Cendes and colleagues, histological regression of Barrett's esophagus was observed in almost 50% of patients one year after RYGBP[32]. In this study, resolution of reflux esophagitis was observed in all patients during the one-year follow-up period, with resolution of GERD symptoms in over 90% of

patients. Additionally, for patients who require revision after SG due to uncontrolled GERD symptoms, the development of Barrett's esophagus, or resistant erosive esophagitis, RYGBP is the procedure of choice, with a resolution of reflux symptoms in over 90% of patients.

Conclusion

There is a clear connection between obesity and gastroesophageal reflux disease (GERD), both in terms of the frequency of GERD symptoms and the presence of esophageal hiatus hernia and GERD complications. Although bariatric surgery has an excellent effect on weight loss and comorbidities associated with obesity, evaluating GERD symptoms and complications is essential before selecting a procedure. This requires upper digestive tract endoscopy before bariatric surgery. The most common bariatric procedure, sleeve gastrectomy, carries a significant risk of exacerbating existing GERD or causing *de novo* GERD. This primarily applies to insufficiently evaluated patients and inadequately performed surgical interventions. On the other hand, RYGBP has a favorable effect on GERD, and this procedure should be recommended to patients with preoperatively verified GERD in the bariatric surgery program. Additionally, RYGBP should be considered the primary form of treatment for patients with BMI over 35 kg/m^2 who require anti-reflux surgery. RYGBP is also the first choice for revision after SG due to uncontrolled GERD symptoms or complications.

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