

Currents and Trends in Bariatric Surgery

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ABSTRACT

Introduction: Bariatric surgery has been shown to be more effective than medical treatment to control overweight. Many techniques have been described in recent years depending on the mechanism involved. Restrictive, malabsorptive and mixed techniques being the first the most commonly practiced by surgeons.

Materials and methods: Review article of the restrictive techniques in bariatric surgery searched the databases PubMed and Cochrane.

Results: Gastroplasty: This consisted of creating a gastric pocket vertically, the short-term results were good, with low excess weight over 60% the first year.

Adjustable gastric banding: The technique consists of a silicone band fitted with an adjustable ball, which is implanted laparoscopically at the gastroesophageal junction; the low weight is lower and slower when compared to the gastric bypass, but can reduce over 60% of excess weight.

Tubular gastrectomy: The surgical technique involves determining a vertical gastrectomy determined by a narrow gastric tube at the expense of the lesser curvature of the stomach and preserving 3 to 4 cm wide, regarding the results in weight loss, a systematic review reported low rates of overweight between 33 and 85%, averaging 55.4%.

Gastric plication: Its principle is basically the dissection of the greater curvature and its plication or invagination into the gastric lumen and lesser curvature, where one or more fixed suture lines, leaving a large intraluminal fold, the percentage of excess weight loss is progressive, stabilizing at 1 year of follow-up in about 60% loss of excess weight, keeping this results at 2 and 3 years of follow-up.

Discussion: The prevalence of obesity is increasing in the recent decade, and now is one of the leading public health problem on a worldwide scale, bariatric surgery is currently the most efficacious and enduring treatment for clinically severe obesity, certainly the training and the bariatric surgeon's experience are important factors that must be improved for the benefit of the patient.

Conclusion: The restrictive bariatric surgery techniques have evolved over the last time, with the help of technological advances that have made possible, allowing improved results. The choice of technique should be very careful, because all have potential complications and risks.

Keywords: Bariatric surgery, Gastroplasty, Adjustable gastric banding, Tubular gastrectomy, Restrictive techniques.

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INTRODUCTION

Actually, bariatric surgery has been shown to be more effective than medical treatment to control overweight and

the diseases associated with it.¹ Furthermore, many techniques have been described in recent years, which have been refined due to technological advances and the complete knowledge of the pathophysiological mechanisms involved in weight loss.

This is how we distinguish the different techniques depending on the mechanism involved. There are purely restrictive techniques, in which the main objective is to limit food intake; malabsorptive techniques, in which the weight loss is achieved mainly by decreasing the absorption of nutrients into the intestine and finally, mixed techniques, involving a combination of these effects to attain the ultimate goal.

This article reviews the restrictive techniques in bariatric surgery.

MATERIALS AND METHODS

For this review, we searched the databases PubMed and Cochrane. We used the MeSH term 'bariatric surgery', in addition to the terms 'gastroplasty', 'restrictive surgery', 'sleeve gastrectomy', 'gastric plication' and 'adjustable gastric band'. Articles were selected for meta-analyses, systematic reviews, randomized clinical trials and, if necessary, cohort studies and case reports were included.

RESULTS

Restrictive Techniques

Gastroplasty

This surgical procedures alter the stomach anatomy due to reduced calorie intake or induced early satiety. The first reports date back since 1973² and consisted of a horizontal division of upper stomach—horizontally gastroplasty, creating a small gastric pocket connected to the rest of the stomach through a small channel in the greater curvature. Due to the failure of this procedure, both suture dehiscence and channel expansion, changes were performed by various authors, such as stapling reinforcements, use of prosthetic materials, meshes or use silicone rings, nonreabsorbible.³⁻⁶ However, despite these changes, poor performance persisted with a low drop of weight loss or weight gain.

In the search for any effective procedure, safe and free of undesirable side effects, reversible and based on gastric restriction, which does not alter the digestion and absorption, Mason in 1980,⁷ developed the calibrated vertical gastroplasty. This consisted of creating a gastric pocket

vertically, next to the lesser curvature of the gastric fundus separated with a stapler.

This reservoir was calibrated with a plug 32 F with a polypropylene mesh reinforcement shaped ring placed at the output, thus commanding the desired gauge. This technique proved to be less technically demanding than the gastric bypass and avoiding complications, such as dumping, ulcers and anemia.

The short-term results were good, with low excess weight over 60% in the first year. However, the percentage of overweight decreased in monitoring and was decreasing in 5 to 10 years, mainly due to dehiscence of the suture line in 48% of patients.^{8,9}

The development of technology allowed this procedure laparoscopically. However, due to poor long-term results, this technique was gradually abandoned and replaced by the gastric bypass as we know it today.

Adjustable Gastric Banding

Subsequently, the exploration of a restrictive procedure to achieve weight loss without the need to divide the stomach continued. Despite previous reports with no adjustable bands, Szinicz in 1980,¹⁰ first implemented in animal models an adjustable gastric band. In 1986, Kuzmak,¹¹ implanted the first adjustable gastric band in humans by open surgery, achieving an adequate weight loss and a low rate of complications. After some modifications and the advent of laparoscopic surgery, gastric band implanted by this approach was first reported by Belachew in 1993,¹² and this method was consolidated as a technique in bariatric surgery, being known as Lap-Band.

The technique consists of a silicone band fitted with an adjustable ball, which is implanted laparoscopically at the gastroesophageal junction. This band is communicated to the outside via a subcutaneous reservoir, which can adjust to demand and loosen by injecting saline solution. This makes possible to regulate the size of the stomach and thus achieve different levels of constraint.

Following international approval, Lap-Band, the most common surgical procedure in European countries, and after approval by the Food and Drug Administration in 2001 began implementation in United States.¹³ Initially indicated for patients with body mass index (BMI) over 40 kg/m² without comorbidities or BMI greater than 35 kg/m², associated comorbidities such as DM2, hypertension, obstructive sleep apnea and degenerative arthropathy. Recently, in 2010 was approved for use in obese patients with BMI between 30 and 35 kg/m² with comorbidities associated.¹⁴

Regarding the results, the low weight is lower and slower when compared to the gastric bypass, but can reduce over

60% of excess weight. This weight loss is gradual and there is proper setting and continuous monitoring.¹⁵ A recent systematic review noted a failure to lose weight as an issue to consider, since this technique has been reported between 31 and 54% of excess weight loss in the first year.¹⁶ Angrisani, in a prospective study, compared the weight loss of the adjustable gastric band vs the gastric bypass after 5 years of follow-up, demonstrating a failure to lose weight, defined as a BMI greater than 35 kg/m², at 34.6% in the adjustable gastric band group compared with 4.2% of the gastric bypass group.¹⁷ This high rate of treatment failure has resulted in a conversion to author procedure at 58% at 7 years of follow-up.¹⁸

While this technique is presented as a safe, with low morbidity and almost no mortality, Dixon and O'Brien,¹⁹ reported a perioperative complication rate of 1.5%. The complications described, from the drilling of the band until the failure to lose weight, will increase to the extent that the adjustable gastric band remains in time. It has been suggested that the rate of complications increases between 3 and 4% per year which remains *in situ*, leading to a rate of 40% up to 10 years.²⁰

Within intraoperative complications, gastric perforation and the splenic lesion can be pointed, which are dependent on the insertion technique. Also can occur outflow tract obstruction of the esophagus, which is checked within 24 hours of running the strip; complications or disconnection of the connector as drilling and reservoir subcutaneous infection, filtration, cutaneous fistula and persistent pain can be mentioned. Slippage or prolapse of the band has been reported in the literature from 0.5 to 36%. This variability is given by different criteria and techniques used in the different series. When this complication occurs it is necessary to loosen the band and recommended his retirement. Erosion or migration of the band is a dreaded complication, reporting from 0.6 to 3% depending on the series and the risk increases as this foreign body remain in contact with the stomach, treatment involves removal of the band.²¹

Gastroesophageal reflux may exacerbate or reappear in one-third of patients. It may also occur in esophageal dilatation, although it is reversible in most cases deflating the balloon, can persist up to 13% of patients.²²

The adjustable gastric band has been shown to produce a low excess weight with few short-term complications. While not always is possible to achieve the desired weight loss may be an alternative for patients who prefer or feel more comfortable with a reversible procedure, less invasive and less perioperative complications. Note that there is no certainty that this low rate of complications last beyond 3 years, which opens the possibility of increased

complications related to gastric banding (erosion, slippage) requiring reoperation.

Tubular Gastrectomy

The tubular gastrectomy was done initially as the duodenal switch restrictive component where its usefulness lay in reducing gastric capacity and produce weight loss in the short term, while the malabsorptive component of the operation (BPD) determined the lower long-term weight. While performing this technique, some patients could not complete the intestinal bypass. Research studies have documented that the tubular gastrectomy alone produced a significant weight loss. Eventually, it became the first time method for high-risk patients, in whom tubular vertical gastrectomy was first performed after weight loss and decrease surgical risk, and then in the process with the gastric bypass was completed.

Early reports from both prospective and retrospective studies have been encouraging the potential benefits of the procedure. Among these include excellent results in weight loss, resolution of comorbidities, relative ease of the technique, avoiding a foreign body or adjustments, shortened operative time and restriction of caloric intake *inmediata*.²³

The surgical technique involves determining a vertical gastrectomy determined by a narrow gastric tube at the expense of the lesser curvature of the stomach and preserving 3 to 4 cm wide.

The concept is simple, but there are some important points in surgical technique, if it is done incorrectly, as it can lead to serious complications. Traditionally it is performed laparoscopically with five ports. For the preparation of gastric tube calibration requires a probe or plug 38 F. Initially, skeletonization of greater curvature of the stomach is performed, severing the vessels at this level inside the gastro-omental arcade, exposing the greater curvature to relieve gastroesophageal junction (angle of His). In the upper segment of the stomach, by sectioning the short vessels, care must be taken to avoid spleen injury, as the bleeding can be substantial and can determine an unplanned splenectomy. Another relevant point during surgery is to release the adhesions of the gastric fundus to the retroperitoneum fundus, as remnant gastric volume may be important, affecting the restriction. Subsequently, calibrated with the spark plug and proceed to the gastric section vertically with endostaplers, which starts between 3 and 4 cm from the pylorus, moving vertically to complete the gastrectomy at the gastric fundus level near the gastroesophageal junction. It is essential that the staple is uniform, symmetrical shaped covering both anterior and posterior, always adjusted to the plug, allowing the tissue

to be present without tension. Some authors recommend suture reinforcement to cover the staple line or simply to reinforce these unions. However, the latter has not shown as a clear advantage over reduce leakage of the suture line.

Regarding comorbidities, it has been observed that a high percentage of their patients improve or have a remission of type 2 diabetes mellitus in a monitoring of 1 to 5 years. In addition, a significant improvement in hypertension and hyperlipidemia, as well as sleep apnea and articular pain has also been observed.²⁴ The results are weight loss and a systematic review reported low rates of overweight between 33 and 85%, averaging 55.4%. In conducting the analysis among patients undergoing gastrectomy as a bridge of tubular gastric bypass and those in which the tubular gastrectomy was performed as a primary single procedure, there was a trend to loss top overweight in the last group (46.9 vs 60.4%). However, this difference is not statistically significant. Studies by imaging have demonstrated a significant dilation of the stomach tubulized at 2 or 3 years period. Still, this is not determined as a failure in the weight loss of the patients.²⁵

Postoperative complications are described from 0 to 15.3% of cases.²⁶ Filtration is the most common complication (2.2-3.3%), in which medical management by interventional radiology or surgery should be evaluated depending on the time of onset, location and severity.²⁷ Other commonly reported complications include gastrointestinal bleeding requiring reoperation or transfusion, and stenosis, which requires surgery or endoscopic, by 1.2 and 0.6% respectively.

The anatomical alteration of the esophagogastric junction may influence the development of gastroesophageal reflux, with a prevalence of 27.5% and endoscopic esophagitis in 15.5%. Postoperative manometric studies have shown an incompetent lower esophageal sphincter in 73% of patients studied by gastroesophageal reflux symptoms.²⁸ Another postoperative changes attributable to the change in gastric anatomy is accelerated gastric emptying in patients with tubular gastrectomy, fact that should be considered to indicate the diet and monitoring of these patients.²⁹ Himpens compared in a prospective randomized study gastric banding with tubular gastrectomy. This study concludes that loss of overweight is higher in the tubular gastrectomy, both the first and the third year of follow-up (41 vs 57.7%) and loss of appetite is higher in the tubular vertical gastrectomy (42.5 vs 75% the first year, 2.9 vs 46.7% at 3 years). Gastroesophageal reflux is most common in the first year post tubular gastrectomy (21.8 vs 8.8%), but then decreased in the third year, increasing significantly with the adjustable gastric band (3.1 vs 20.5%).³⁰ Karamanakos, in a prospective randomized study, compares the tubular gastrectomy and gastric bypass, which reported better

weight loss rate in the tubular gastrectomy at 1 year of follow-up. This result is attributed to a hormonal effect in appetite suppression, plus gastric restriction properly.³¹

The classic indications for tubular gastrectomy are morbidly obese (BMI > 40 kg/m²) and patients with BMI > 35 kg/m² associated comorbidities. Moreover, according to the latest consensus of experts published in 2012, is accepted tubular gastrectomy as a single procedure in the treatment of obesity as a valid option in adolescent patients, elderly, high-risk surgical candidates for transplant (kidney and liver) and with inflammatory bowel disease. It is accepted in patients with morbid obesity and metabolic syndrome in patients with BMI 30 to 35 kg/m² with comorbidities. It is considered an absolute contraindication for the presence of Barrett's esophagus for tubular gastrectomy.³²

Gastric Plication

This technique, first described by Amoli and Talebpour, decreases the gastric lumen at the expense of greater curvature. Similar to a gastric sleeve, but without partial gastric resection or implant use. Multiple techniques have been described; its principle is basically the dissection of the greater curvature and its plication or invagination into the gastric lumen and lesser curvature, where one or more fixed suture lines, leaving a large intraluminal fold. The end of the gastric lumen diameter is calibrated with a spark plug. The results published by the original authors report a prospective series of 100 cases with an average BMI of 47 (range, 36-58 and 30-35 kg/m²), where the percentage of excess weight loss was progressive, stabilizing at 1 year of follow-up in about 60% loss of excess weight, keeping this results at 2 and 3 years of follow-up.³³

Ramos, reports in a prospective series that included 42 patients with BMI > 40 or BMI > 35 kg/m² associated with any comorbidity, where plication was performed laparoscopically with in 24 months of follow-up. This monitoring shows that already in the first month there is a decrease of excess weight of 20%, with a gradual downward trend and the rate of overweight decreased from 62% at 18 months follow-up. It has been found that patients with BMI > 45 kg/m² have a less percentage of weight loss compared with the patients that have a lower BMI, reason why most authors do not indicated this technique for BMI > 50 kg/m².³⁴

In terms of technique and postoperative complications, Ramos, describes an average of 50 minutes operative time, with no intraoperative complications or conversion to open surgery, which is consistent with other authors. In this series the most common early complications were nausea, vomiting and drooling, which were transient and

disappeared within 2 weeks postoperatively. Major complications have been described as suture dehiscence, secondary filtration repeated vomiting, gastrointestinal bleeding, perforated gastric ulcer, gastric obstruction and thrombosis portomesentéric.³³⁻³⁵ The overall complication rate is around 8.8%.

This practice has emerged as a new alternative in restraint techniques, with promising short-term results in terms of weight loss and complication rate, in addition to being a potentially reversible technique. However, no studies show its effectiveness in long-term monitoring.

DISCUSSION

The prevalence of obesity is increasing in the recent decade, and now is one of the leading public health on a worldwide scale. Bariatric surgery is currently the most efficacious and enduring treatment for clinically severe obesity, and as a result, the number of bariatric surgery procedures performed has risen dramatically in the last years.^{36,37}

There are two well-design prospective and observational studies of bariatric surgery patients and matched morbidly obese controls with long-term follow-up (>10 years); the Swedish Obese Subjects (SOS) study and a 2-cohort study conducted at the McGill University Health Center. The SOS authors report that at the 10-year follow-up, weight loss was 25% of total body weight for gastric bypass patients, 16.5% for vertical banded gastroplasty, and 13.2% in the fixed gastric banding subgroup, while the matched controls experienced a 1% weight gain.³⁸

A meta-analysis of total surgical mortality in 85,048 patients undergoing a spectrum of bariatric procedures reports that the early total mortality was 0.28%, whereas the late total mortality (30 days and 2 years) was 0.35%. In another systematic review, the mortality rate at the first 30 days was 0.19%.^{39,40} Recently, DeMaria et al developed a clinically relevant 5-point scoring system, with the aid of this tool, the mortality risk of patients is defined as low-(0-1p), intermediate-(2-3p) and high-risk (4-5p). Certainly, the training and the bariatric surgeon's experience are important factors that must be improved for the benefit of the patient.⁴¹ One of the most problematic issues is not meeting the patients expectation, as regards with weight loss. Reoperations are technically more difficult than primary procedures and have high perioperative complication. In the SOS study among 1,338 subjects with following at least of 10 years, the frequency of reoperation was 31% for gastric banding and 17% for gastric bypass.⁴²

A recent survey reported that 90% of world bariatric surgery was performed laparoscopically. More specifically,

laparoscopic adjustable gastric band (LAGB) was performed in 42.3% worldwide, Laparoscopic standard Roux-en-Y gastric by-pass (LRYGB) in 39.7%, open standard Roux-en-Y gastric by-pass (ORYGB) in 5.7%, and laparoscopic sleeve gastrectomy (LSG) in 5.1%.⁴³

CONCLUSION

Bariatric surgery is an invasive treatment for obesity and is often viewed as the 'last chance' for patients, research focused on improving outcome for patients who fail to achieve or maintain weight loss following surgery is a priority. The restrictive bariatric surgery techniques have evolved over the last time, with the help of technological advances that have made possible, allowing improved results. The choice of technique should be very careful, because all have potential complications and risks. Moreover, patient selection also candidate for these procedures must be rigorous and based on medical criteria, backed by scientific evidence and with the support of a multidisciplinary team.

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