Laparoscopic adjustable gastric banding and laparoscopic sleeve gastrectomy: which has a place in the treatment of diabetes in morbidly obese patients?

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Abstract

Laparoscopic adjustable gastric banding (LAGB) and laparoscopic sleeve gastrectomy (LSG) are two bariatric procedures approved for the management of morbidly obese patients. According to a meta-analysis of all obese patients who underwent bariatric procedures, 11% also had type 2 diabetes mellitus (T2DM) before surgery, and improvement or resolution of this co-morbidity was highlighted in many of the studies. However, the mechanism(s) of action underlying such an effect with the various types of bariatric procedure remain unclear. Also, in terms of weight loss, the most efficient operations are those that come with a high rate of morbidity. This means that the choice of procedure is best done after a multidisciplinary team discussion with the patient in an effort to predict the beneficial effects and risks of each possible procedure. However, for years now, the bariatric team at Montpellier Hospital has preferred either LSG or LGBP as the treatment of choice for morbidly obese patients with T2DM, given the higher rates of failure with LAGB over time compared with the excellent results achieved by both LSG and LGBP in many studies.

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Keywords: Gastric banding; Sleeve gastrectomy; Bariatric surgery; Obesity; Type 2 diabetes mellitus; Review

Résumé

Gastroplastie par anneau ajustable ou gastrectomie en manchon laparoscopiques: quelle technique pour traiter les diabétiques de type 2 atteints d'obésité morbide?

La gastroplastie par anneau ajustable et la gastrectomie en manchon sont deux techniques chirurgicales validées pour la prise en charge de patients obèses morbides. 11 % de patients qui bénéficient de ce type de chirurgie présente un diabète de type 2. De nombreuses études ont souligné l'efficacité de ces opérations sur la résolution ou l'amélioration du diabète de type 2. Cependant les mécanismes d'actions sont mal connus. Les procédures les plus efficaces étant les plus morbides, le choix de la technique opératoire doit être réalisé en concertation pluridisciplinaire après information et accord du patient. L'équipe du CHU de Montpellier a décidé au vue de l'analyse de la littérature et de son expérience importante dans ce domaine de proposer la gastrectomie longitudinale et le court circuit gastrique comme procédure de choix dans cette indication en raison des effets hormonaux digestifs décrits après ces opérations, et d'un taux d'échec à long terme de la gastroplastie par anneau jugé trop important.

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Mots clés : gastroplastie par anneau, gastrectomie longitudinale, chirurgie bariatrique, obésité, diabète de type 2, revue générale.
1. Introduction

Laparoscopic adjustable gastric banding (LAGB) and laparoscopic sleeve gastrectomy (LSG) are two bariatric procedures approved for the management of morbidly obese patients [1]. The gastric band is an inflatable silicone device that is placed around the upper part of the stomach to create a 20-cc gastric pouch that is distended during every meal. The gastric band is connected by tubing to a reservoir inserted under the skin that changes the pouch diameter and, thus, regulates the transit of food [2]. The result is early and complete satiety. This is a solely restrictive procedure that has no direct impact on ghrelin regulation [3]. In contrast, LSG consists of permanently removing two-thirds of the stomach using longitudinal partial gastrectomy, a procedure approved by the French Ministry of Health ever since the Haute Autorité de Santé (HAS; National Authority for Health) report in 2008 considered it another purely restrictive procedure [4]. However, hormonal variations [in ghrelin, glucagon-like peptide-1 (GLP-1) and peptide YY (PYY)] have recently been described [5,6]. Resection of the fundus (site of ghrelin secretion) and quicker gastric emptying that, in turn, propels food more rapidly into the bowel may be explanations for the hormonal effects. Both surgical procedures are effective in terms of weight loss [1], as both can achieve an average of 50–65% excess weight loss in the mid-term [7–9]. In the long term, however, the results for LAGB are less impressive (35–50%) [1,9] whereas, for LSG, there is a complete lack of data so far.

According to a meta-analysis of all obese patients who underwent bariatric procedures, 11% also had type 2 diabetes mellitus (T2DM) before surgery [9], and improvement or resolution of this co-morbidity was highlighted in many of the studies [1,10–19]. In addition, the efficacy of biliopancreatic diversion (BPD), with or without duodenal switch (DS), and gastric bypass (GBP) are well established, and several hormonal effects (decreased ghrelin, and increased PYY and GLP-1) that may be due to the duodenopancreatic shunt and/or the rapid arrival of food in the bowel as well as the weight loss of the patient.

However, the impact of LAGB on T2D is more controversial. On the basis of reports in the literature from 1990 to 2006 considered in a recent meta-analysis, Buchwald et al. [10] observed remission of T2DM in 56.7% of patients who underwent LAGB that was maintained for some time: 55% [10] observed remission of T2DM in 56.7% of patients who underwent LAGB that was maintained for some time: 55% (P = 0.231). However, preoperative HbA1c levels were found to be correlated with stopping medical treatment, as better results were achieved in patients who had HbA1c levels < 7% prior to surgery (P = 0.037). Nevertheless, no differences were found between the two types of surgery in terms of effects on HbA1c levels (P = 0.552) and evolution of pharmacological treatment (P = 0.037). Moreover, the bariatric centre at Montpellier Hospital presented the post-bariatric-surgery results of 282 diabetic patients [21] LAGB, 53 laparoscopic GBP (LGBP) and 11 BPD/DS. With LAGB, the percentages of excess weight loss after 1 and 2 years were 43% and 50%, respectively, while the percentages of patients still using antidiabetic agents were 39% and 34%, respectively, and the percentages of patients treated with insulin were 14% and 18%, respectively.

As for LSG, intermediate-term studies have reported on the effects of this procedure on T2D resolution. In a comparative study of 39 patients who underwent LSG vs 52 who underwent LGBP, Vidal et al. [15] found that the two procedures were similarly effective after 1 year (84.6% rate of T2D cure). In addition, Silecchia et al. [16] reported resolution of non-insulin-dependent diabetes in 69.2% and improvement in 15.4% at 12 months, and in 76.9% and 15.4%, respectively, at 18 months, in super-obese patients after LSG. Furthermore, the bariatric centre at Montpellier Hospital presented to the 2009 Congress of the International Federation for the Surgery of Obesity (IFSO) the results of a prospective multicentre study comparing the impact of LSG and LGBP on HbA1c levels and the treatment of T2D in severely or morbidly obese patients after 1 year [17]. The study included 35 patients in the LGBP group and 33 in the LSG group, and all had been treated with either oral antidiabetic drugs (OADs) or insulin before the operation (32 were taking OADs and three were taking insulin in the LGBP group, while 27 were taking OADs and six were taking insulin in the LSG group). The average BMI in the LGBP group was 47.9 kg/m², in the LSG group, 50.6 kg/m². At 1 year after surgery, the operation was successful (defined as stopping or reducing the use of medications, or HbA1c levels < 7%) in 100% of the patients (P = 0.037). Nevertheless, no differences were found between the two types of surgery in terms of effects on HbA1c levels (P = 0.552) and evolution of pharmacological treatment (P = 0.037). However, preoperative HbA1c levels were found to be correlated with stopping medical treatment, as better results were achieved in patients who had HbA1c levels < 7% prior to surgery (P = 0.037). Nevertheless, no differences were found between excess weight loss and reduction of HbA1c (P = 0.681).

In a retrospective study by Rosenthal et al. [18], the results at 2 and 6 months after LSG in 30 patients with T2DM, for which 22 (73%) had been taking medications preoperatively, showed that resolution of T2D occurred in 27% at 2 months and in 63% at 6 months of follow-up. HbA1c levels decreased from 6.36 ± 0.82% (n = 14) before surgery to 6.02 ± 0.57 regulation of glycaemia. Indeed, after 2 years, 73% of the surgery group vs only 13% in the drug-treatment group saw a resolution of their T2DM in this study. Parikh et al. [14] presented the post-bariatric-surgery results of 282 diabetic patients [218 LAGB, 53 laparoscopic GBP (LGBP) and 11 BPD/DS]. With LAGB, the percentages of excess weight loss after 1 and 2 years were 43% and 50%, respectively, while the percentages of patients still using antidiabetic agents were 39% and 34%, respectively, and the percentages of patients treated with insulin were 14% and 18%, respectively.

In conclusion, bariatric surgery is an effective treatment for T2DM, and the impact of LAGB and LSG is comparable. The future role of LAGB and LSG in the management of T2DM will be determined by further clinical studies.
(n = 11) at 2 months and to 5.92 ± 0.33 (n = 12) at 6 months after surgery. BMI decreased from 46.12 ± 10.86 kg/m² (n = 30) before the operation to 38.27 ± 6.59 kg/m² (n = 30) at 2 months and to 35.78 ± 5.11 kg/m² (n = 29) at 6 months after it. Patients with a shorter duration of T2DM (<5 years) and greater weight loss after surgery achieved higher resolution rates.

A comparative study of LAGB and partial gastrectomy (n = 27), LSG (n = 53) and LAGB (n = 100), by Frezza et al. [19], found that, at 12 and 18 months, LSG led to greater excess weight loss (P < 0.05) and lower blood glucose levels (P < 0.05) than did LAGB. The authors concluded that LSG offers better weight loss and glucose control at both 1 and 1.5 years post-surgery than does LAGB, suggesting that gastric fundus resection plays an important—albeit not yet well-defined—role. Shah et al. [20] evaluated the impact of LSG on glycemic control in obese Indian patients with T2D, with emphasis on its speedy resolution. At 1 month after surgery, 81.2% of patients had stopped their antidiabetic medications and, at 1 year after surgery, 100% of patients had improved and 96.2% had resolved their diabetes. Such a rapid resolution of T2DM appears to be due to a number of changes in digestive-hormone regulation. In a randomized, prospective, parallel-group study, Peterli et al. [21] evaluated the effects of laparoscopic roux-en-Y gastric bypass (LGBP) and LSG on fasting and meal-stimulated insulin, glucose and GLP-1 levels. Both body weight and BMI decreased markedly (P < 0.002) and similarly with either procedure. Excess BMI loss was similar at 3 months (43.3 ± 12.1% vs 39.4 ± 9.4%; P > 0.36). Also, after surgery, the patients had markedly increased postprandial plasma insulin and GLP-1 levels (P < 0.01) after either surgical procedure, thereby leading to improved glucose homeostasis. However, compared with LSG, LGBP patients showed early augmented insulin responses (within 1 week of surgery), thus potentially mediating greater early glycaemic control. Nevertheless, after 3 months, no significant differences were observed in terms of insulin and GLP-1 secretion between the two procedures. These results do not support the idea that the proximal small intestine mediates improvement in glucose homeostasis.

2. Conclusion

Bariatric surgery has demonstrated unquestionable efficacy in the treatment of T2DM in patients who are also morbidly obese. However, the mechanism(s) of action underlying such an effect with the various types of bariatric procedure remain unclear. Also, in terms of weight loss, the most efficient operations are those that come with a high rate of morbidity. This means that the choice of procedure is best done after a multidisciplinary team discussion with the patient in an effort to predict the beneficial effects and risks of each possible procedure. However, for years now, the bariatric team at Montpellier Hospital has preferred either LSG or LGBP as the treatment of choice for morbidly obese patients with T2DM, given the higher rates of failure with LAGB over time compared with the excellent results achieved by both LSG and LGBP in many studies.

Conflicts of interests

D. Nocca is consultant for Ethicon and for Tutogen.

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