

GASTROPLASTY AS A TREATMENT FOR TYPE 2 DIABETES MELLITUS*Gastroplastia como tratamento do diabete melito tipo 2*Alcides José **BRANCO-FILHO**, Aline Moraes **MENACHO**, Luis Sérgio **NASSIF**, Lie Mara **HIRATA**,
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ABSTRACT - Background - Diabetes mellitus type 2 is not infrequently associated with obesity and can be prevented, improved and even reversed with the different types of bariatric operations. **Aim** - To compare serum glucose levels on pre and post-operative periods in patients undergoing gastroplasty with Capella and gastric sleeve techniques. **Method** - A descriptive and prospective analysis of serum glucose levels was done on pre and post-operative patients undergoing these operations. **Results** - Of the 83 patients analyzed, 76 (91.5%) were female. Ages ranged from 21 to 64 years, with average age of 44 years. Seventy-seven (92.7%) underwent gastroplasty (Capella) and six (7.3%) to gastric sleeve. The pre-operative blood glucose ranged from 125 to 500 mg / dL and dropped to 76 to 120 mg / dL in the post-operative period of three months. Of the 77 patients taking medication for diabetes, 57 had metformin 850 to 3500 mg daily, 18 glibenclamide 5 to 10 mg per day and 17 insulin. After three months of operation, 92.2% stopped using drugs for diabetes and 100% of those who remained medicated decreased from more than 65% the dose of the drug, and none remained dependent of insulin treatment. **Conclusion** - Bariatric surgery is effective method to improve and even reverse type 2 diabetes mellitus.

HEADINGS - Gastroplasty. Diabetes mellitus. morbid obesity.**Correspondence:**Alcides José Branco Filho,
e-mail: ajbranco@terra.com.brFinancial source: none
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Accepted for publication: 19/07/2011**DESCRITORES** - Gastroplastia. Diabetes mellitus. Obesidade mórbida.

RESUMO – Racional - O diabete melito tipo 2 está, com certa frequência, associado à obesidade mórbida e pode ser prevenido, melhorado e até mesmo revertido com as diversas modalidades de operações bariátricas. **Objetivos** - Comparar as glicemias séricas pré e pós-operatórias dos pacientes submetidos à gastroplastia com as técnicas de Capella e sleeve gástrico. **Método** - Estudo descritivo e prospectivo com análises das glicemias séricas pré e pós-operatórias de pacientes submetidos à gastroplastia. **Resultados** - Dos 83 pacientes analisados, 76 (91,5%) eram do sexo feminino. A idade variou de 21 a 64 anos, sendo 44 anos a idade média. Setenta e sete (92,7%) foram submetidos à gastroplastia (Capella) e seis (7,3%) à sleeve gástrico. A glicemia pré-operatória variou de 125 a 500 mg/dL caindo para a variação de 76 a 120 mg/dL no pós-operatório de três meses. Dos 77 pacientes que usavam tratamento medicamentoso para a diabete, 57 tomavam metformina de 850 a 3500 mg por dia, 18 glibenclamida de 5 a 10 mg por dia e 17 insulina. Após 3 meses da operação, 92,2% cessaram o uso de medicamentos para diabete e em 100% dos que permaneceram medicados houve redução de mais de 65% na dose do fármaco, sendo que nenhum permaneceu dependente de insulina no tratamento. **Conclusão** - A cirurgia bariátrica constitui-se em método eficaz para a melhora e até mesmo reversão do diabete melito tipo 2.

INTRODUCTION

Diabetes mellitus type 2 is currently epidemic disease that affects more than 150 million people worldwide. The relationship between diabetes and obesity is well established: 90% of type 2 diabetic patients are overweight and obese, whereas each increase of 20% above ideal body weight, increases twice the possibility to become diabetic patient.

Obesity is a chronic situation, carrying multifactorial metabolic problem difficult to control. Patients who do not respond to medical treatment and have medical indications are candidates for bariatric

surgery. After the operation, the decrease in visceral fat makes less insulin resistant patients with clinical and laboratory better results in 70 to 90% of them.

The objective of this study was to compare blood glucose levels and drug use by obese and diabetic patients before and after bariatric surgery.

METHODS

A prospective descriptive study of patients operated between 2008 to 2010 submitted to gastric sleeve and the Capella procedure at the Hospital Santa Casa de Misericórdia de Curitiba, Brazil; all of them had previous diagnosis of diabetes mellitus or glucose intolerance. Serum glucose levels were measured preoperatively and at routine follow-up postoperatively. They were followed-up in the first 12 months after the operation for changes in glucose levels.

The results were tabulated based on hospital records, gender, age, date, surgical procedure, blood glucose levels and hypoglycemic medications preoperatively and postoperatively used. Was not considered the period before three months after surgery, since the weight loss in this time interval is not sufficient to justify the improvement in glucose levels.

Inclusion criteria were: patients operated at the research hospital with gastric sleeve and Capella techniques, with body mass index (BMI) greater than or equal to 35 kg/m² with diabetes mellitus or BMI greater than 40 kg/m² and glucose intolerance. All patients agreed to participate voluntarily in this study and signed the informed consent form.

Exclusion criteria were: patients without hyperglycemia in tests performed preoperatively. Eighty three patients met all requirements and were included.

RESULTS

Seventy six (91.5%) were female with ages ranging from 21 to 64 years, average 44 years and 77 of all 83 patients (92.7%) underwent Capella gastroplasty and six (7.3%) gastric sleeve. The preoperative blood glucose ranged from 125 to 500 mg/dL dropped to 76-120 mg/dL in the postoperative period of three months. Of the 77 patients taking medication for diabetes, 57 used metformin from 850 to 3500 mg daily, 18 glyburide 50 to 10 mg per day and 17 insulin. After three months of operation, 92.2% stopped using drugs for diabetes and 100% of those who remained medicated, decreased more than 65% the used dose before treatment; none remained insulin dependent. All patients showed significant reduction in body mass index.

DISCUSSION

Obesity is chronic disease characterized by excessive accumulation of body fat. The risks associated to it has been considered major public health problem in developed countries.

The World Health Organization classifies obese based on Body Mass Index and the risk of associated mortality. Thus, it is considered obese when BMI is above 30 kg/m². Considering the gravity, the World Health Organization defines grade I obesity when BMI is between 30 and 34.9 kg/m², class II obesity when it is between 35 and 39.9 kg/m² and, finally, class III obesity when it exceeds 40 kg/m².

As far as it is a chronic medical condition, including multiple factors, the treatment involves different approaches (nutritional, anti-obesity drugs and physical exercise)^{4,29}. However, many patients do not respond to these maneuvers, requiring more effective intervention. Bariatric surgery has proved to help clinical cases of obesity. The indication of this intervention is growing today and is based on comprehensive analysis of multiple aspects of the patient. Are candidates for surgical treatment (bariatric surgery) patients with BMI greater than 40 kg/m² or greater than 35 kg/m² with comorbidities (hypertension, dyslipidemia, diabetes mellitus type 2, sleep apnea). Patient selection requires at least five years of development of obesity and a history of failure of conventional treatment carried out by qualified professionals. The operation would be contraindicated in patients with severe lung disease, kidney failure, severe myocardial damage and liver cirrhosis.

The prevalence of morbid obesity continues to rise rapidly in the world. It is strongly associated with diabetes mellitus type 2, which makes serious public health problem. In the U.S. the prevalence increased 198%, and from the 16.2 million obese people in 2005 the forecast is to increase to 48.3 million in 2050²⁰.

Despite the public awareness of the importance of weight loss, obesity has become in recent years, the global epidemic. Over 80% of individuals with diabetes mellitus type 2 are overweight or obese. Every 20% increase in body weight above ideal, doubles the likelihood of the patient becoming a carrier¹³. Being a state of insulin resistance associated with excess visceral fat¹¹, obesity treatment must be focused to prevention, improvement and reversal of diabetes mellitus type 2 (between 70 and 90% of cases). Obesity affects more than 150 million people around the world and is expected to double in the first six decades of this millennium. Of this total, approximately 90% are overweight or obese²² and the degree of obesity is the main predictor of the occurrence of diabetes in a population¹⁶.

Of all the diseases associated with obesity, one that has better control after bariatric surgery is the diabetes⁸. Among the surgical options available, the gastric Roux-en-Y bypass is the most widely used. This operation produces gastric restriction, which leads to early satiety and consequently decreases the size of meals. However, if this was the only mechanism responsible for, the energy homeostasis system would cause a compensatory increase in the frequency and quantity of caloric meals¹⁴. The gastric bypass also includes the deletion of the proximal digestive tract due to Roux-en-Y.

Ghrelin is a hormone produced, almost in its entirety, in the gastric fundus that is an excluded area after bypass². This peptide is the only hormone known as enteric stimulator of appetite^{17,21,32}. Its increase in plasma occurs before feeding with subsequent drop, reinforcing the hypothesis of the role of this hormone as orexigenic^{9,10}. It seems, however, that he has no direct effect on the control of diabetes, which occurs after the operation. It may even have a contrary effect on release and action of insulin³¹.

Some other hormones such as peptide YY (PYY) and "glucagon-like peptide-1" (GLP-1), are produced at the end of the ileum through the stimulation caused by the presence of food in this site. The L-type endocrine cells monitor the content in more distal part of small intestine and colon. These cells release PYY in response to the presence of bile, fat, glucose and amino acids³. GLP-1 is an incretin produced in the digestive system and acts directly on the pancreas to stimulate insulin secretion¹⁸. GLP-1 may also inhibit gastric emptying and, consequently, decreases food intake¹³.

Thus, the major restraining effect, the malabsorption and hormonal effects become responsible for weight loss and control of disease¹⁸.

Experimental study by Rubino and Marescaux²⁷, confirmed the hypothesis of the value of the proximal intestine in the control of diabetes. Other authors²³ believe in the value of the proximal intestine in the pathogenesis of diabetes mellitus type 2, and that the exclusion of this segment would modify the signals to the pancreas interfering on incretins produced in this region.

Another hypothesis is based on the fact that bariatric surgeries like gastric bypass Roux-en-Y and biliopancreatic derivations allow the presence of poorly digested food early in the distal small intestine. The presence of these nutrients in the ileum decreases gastrointestinal motility, gastric emptying, the speed of transit from the mouth to the cecum and consequently food intake, known as ileal brake mechanism³⁰. This neural mechanism would be mediated by hormones produced in the ileum as the PYY and GLP-1^{7,19,26}. According to this line, the improvement of diabetes after bariatric

surgery is related to the distal intestine and not to the proximal one.

After the operation, the resolution of diabetes occurs early, even before major weight loss²⁸. This fact can be explained by the stimulation of endocrine production, even in early postoperative period²⁵.

One of the first large series of operations in diabetic patients was the study of Greenville (USA), in which 165 diabetic patients were treated by gastric bypass and 83% of them remained in remission in 14 years of follow-up²⁴.

Buchwald et al.⁵ performed a meta-analysis with 22,094 patients with diabetes mellitus type 2 with different types of operations as gastric banding, Roux-en-Y gastric bypass and biliopancreatic diversion, comparing the loss of weight excess and diabetes resolution after each of these operations. The results were gastric band weight loss of 47.5% and resolution of diabetes of 47.9%; 61.6% of weight loss and 83.7% resolution of diabetes on gastric bypass and 70.15% weight loss with 98.9% remission of diabetes in the biliopancreatic diversion.

Several other studies show remission between 70% and 90% of cases, apparent lower rates in patients using insulin for several years in which the functional capacity of beta cells may be committed in large scale. On the other hand, there is reversal of diabetes in all the patients using oral hypoglycemic agents after the operation.

There are no data on the impact of the operation on the chronic micro and macrovascular complications of diabetes. Likewise, it is unclear if there will be increased longevity in these patients.

The purely restrictive operations, such as the old Mason's vertical banded gastroplasty or gastric banding, lead to reduction of insulin resistance due to weight loss in itself. There are no positive surgical results on the remission of diabetes in Brazil, besides weight loss of 25% of body weight after 10 years of gastric bypass versus 13% in gastric band. The reduction of insulin is mentioned to be 54% and 25%, respectively, corroborating the perception of inferiority of purely restrictive techniques.

Disabsorptive procedures are effective in reducing weight and improving insulin sensitivity. Currently, the biliodigestive derivation - known in Brazil as Scopinaro operation -, has average weight loss of 80% of the initial excess weight with reversal of diabetes in at least 85% of cases. The success of this operation in diabetic patients is a reflection of malabsorption of lipids (lipotoxicity reduction) and strong improvement in insulin sensitivity. Reports comparing the gastric bypass (Capella) and Scopinaro on insulin resistance show that the latter leads to improved insulin sensitivity more intense than Capella. This, however, does not give superiority to malabsorptive operation, since chronic complications, such as malnutrition, are more

frequent in this procedure. Furthermore, remission rates of diabetes appear to be greater at Capella.

Vertical gastroplasty with jejuno-ileal bypass is classically known as a mixed predominantly restrictive component of the malabsorptive. The tendency to name it as incretin-satiety is based on the accumulated knowledge regarding the hormonal mechanisms of weight loss and improvement of co-morbidities, especially the reversal of diabetes. Observational studies show improved glycemic control a few days after the operation. This acute improvement can not be attributed to either the weight loss or improvement on insulin resistance. In fact, the marked decrease in food intake accompanied by a paradoxical reduction in appetite is attributed to reduced production of the hormone ghrelin (an endogenous orexigenic) from fundus. This reduction should be important in preventing weight regain in the long term, characterizing the effect of this procedure in satiety. The reversal of diabetes is due to increase in insulin sensitivity associated with improved beta cell function. This recovery is due to an increase in gastro-intestinal hormone action incretin, glucagon like peptide 1 (GLP-1), which increases the jejuno-ileal bypass. Thus, the operation of Capella can be considered as a procedure with positive results due to modulation of incretin hormones and, so, being the gold standard operation for the morbidly diabetic obese people.

The gastric bypass operations have been associated with prevention of 99% to 100% of cases of impaired glucose tolerance in midterm follow-up. The first focused paper on prevention was conducted by Long et al. The authors observed that the relative risk of developing diabetes is 30 times lower in operated morbidly obese patient compared with non-operated.

In 1998, Hickey et al.¹⁵ launched the question, type 2 diabetes would be a surgical condition? The answer was yes. The authors appreciated the clinical improvement of the diabetes, while recognizing the limitations in knowledge of pathophysiology at the time.

The optimal control of diabetes mellitus type 2 is the measurement of glycated hemoglobin before and after six months of operation. However, due to the high cost of the exam and the need to monitor these patients assiduously as outpatient, this measure is still difficult to be put in practice nowadays.

CONCLUSION

Bariatric surgery with Capella and gastric sleeve procedures are 100% efficient measures for weight loss and reduction of blood glucose levels in diabetic patients.

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