Laparoscopic treatment of metabolic syndrome in patients with type 2 diabetes mellitus

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Received: 12 June 2007 / Accepted: 24 January 2008 / Published online: 18 March 2008 © Springer Science+Business Media, LLC 2008

Abstract

Background Metabolic syndrome refers to risk factors for cardiovascular disease. Hyperglycemia is a critical component contributing to the predictive power of the syndrome. This study aimed to evaluate the results from the laparoscopic interposition of an ileum segment into the proximal jejunum for the treatment of metabolic syndrome in patients with type 2 diabetes mellitus and a body mass index (BMI) lower than 35.

Methods Laparoscopic procedures were performed for 60 patients (24 women and 36 men) with a mean age of 51.7 ± 6.4 years (range, 27–66 years) and a mean BMI of 30.1 ± 2.7 (range, 23.6–34.4). All the patients had a diagnosis of type 2 diabetes mellitus (T2DM) given at least 3 years previously and evidence of stable treatment using oral hypoglycemic agents, insulin, or both for at least 12 months. The mean duration of type 2 diabetes mellitus was 9.6 ± 4.6 years (range, 3–22 years). Metabolic syndrome was diagnosed for all 60 patients. Arterial hypertension was diagnosed for 70% of the patients (mean number of drugs, 1.6) and hypertriglyceridemia for 70%. High-density lipoprotein was altered in 51.7% of the patients and the abdominal circumference in 68.3%. Two techniques were performed: ileal interposition (II) into the proximal jejunum and sleeve gastrectomy (II-SG) or ileal interposition associated with a diverted sleeve gastrectomy (II-DSG).

Results The II-SG procedure was performed for 32 patients and the II-DSG procedure for 28 patients. The mean postoperative follow-up period was 7.4 months (range, 3–19 months). The mean BMI was 23.8 ± 4.1 kg/m², and 52 patients (86.7%) achieved adequate glycemic control. Hypertriglyceridemia was normalized for 81.7% of the patients. A high-density lipoprotein level higher than 40 for the men and higher than 50 for the women was achieved by 90.3% of the patients. The abdominal circumference reached was less than 102 cm for the men and 88 cm for the women. Arterial hypertension was controlled in 90.5% of the patients. For the control of metabolic syndrome, II-DSG was the more effective procedure.

Conclusions Laparoscopic II-SG and II-DSG seem to be promising procedures for the control of the metabolic syndrome and type 2 diabetes mellitus. A longer follow-up period is needed.

Keywords Arterial hypertension · Cardiovascular disease · Diabetes · Dyslipidemia · Ileal interposition · Metabolic syndrome
Metabolic syndrome has been well recognized in the medical literature since Reaven’s [1] report that several risk factors for cardiovascular disease commonly cluster together. Patients with metabolic syndrome and type 2 diabetes mellitus (T2DM) have the highest prevalence of coronary heart disease (CHD), and those who have diabetes without metabolic syndrome have no greater prevalence of CHD than those with neither [2].

A number of organizations have developed different definitions for metabolic syndrome [3–6], but those of the World Health Organization (WHO) and the Third Report of the National Cholesterol Education Program’s (NCEP) Adult Treatment Panel (ATPIII) have been the most frequently used. Despite the different criteria used for defining metabolic syndrome, with different cut points, probably affecting the sensitivity and specificity of the diagnosis, Ford and Giles [7] showed in an adult US population that metabolic syndrome was identified in the same proportion by the WHO and ATPIII criteria. However, approximately 15% to 20% of the individuals were classified as having the syndrome by one set of criteria but not the other.

Abdominal obesity is considered mainly responsible for the rising prevalence of metabolic syndrome. Obesity and T2DM are diseases of epidemic proportions, and the association between them is well established.

It is postulated that the pathologic sequence of events leading to T2DM is characterized by failure of beta cells to secrete adequate amounts of insulin to compensate for insulin resistance in peripheral tissues and by increased endogenous glucose production [8]. Insulin resistance, or hyperinsulinemia, is key in the pathogenesis of metabolic syndrome, with the term “insulin resistance syndrome” also commonly used. The dissociation of obesity and insulin resistance in patients with the metabolic syndrome is difficult.

Weight loss is beneficial for patients with obesity, T2DM, and metabolic syndrome. However, long-term realistic weight loss by nonsurgical methods has a variable impact on glycemic control, and only a proportion of T2DM patients have a worthwhile response [9].

Bariatric surgery, especially gastric bypass [10] and malabsorptive surgeries [11], are effective in achieving long-term control of obesity and in controlling T2DM. De Paula et al. [12] performed a technique termed “neuroendocrine break” characterized by a sleeve gastrectomy associated with an ileal interposition. They reported complete resolution of T2DM for morbidly obese patients. The mechanisms in relation to the ileal interposition and sleeve gastrectomy involved providing early exposure of ingested nutrients to the interposed ileum aimed at determining an early rise in glucagon like peptide 1 (GLP-1) and consequently influencing the defective early-phase insulin secretion. The aim is to induce an adjustable and long-lasting weight loss, to restrict the caloric intake, and to diminish or abolish excessive stimulation of the duodenum.

This study aimed to evaluate the results for laparoscopic interposition of an ileum segment to the proximal jejunum associated with either sleeve gastrectomy or diverted sleeve gastrectomy used to treat the components of metabolic syndrome experienced by T2DM patients with a body mass index (BMI) lower than 35.

Materials and methods

Until September 2006, 60 patients with metabolic syndrome and T2DM were submitted to laparoscopic ileal interposition (II) associated with either a sleeve gastrectomy (II-SG) or ileal interposition related to a diverted sleeve gastrectomy (II-DSG). The 60 patients comprised 36 men (60%) and 24 women (40%) with a mean age of 51.7 ± 6.4 years (range, 27–66 years). The demographic data from each operation are summarized in Table 1. All the patients had a BMI lower than 35 kg/m². The preoperative BMI ranged from 23.6 to 34.4 (mean, 30.1 ± 2.7 kg/m²).

A number of risk factors and other variables related to metabolic syndrome were assessed at baseline. The components of metabolic syndrome were defined according to the Third Report of the National Cholesterol Education Program’s Adult Treatment Panel (ATPIII). The presence of T2DM did not exclude the diagnosis of metabolic syndrome [13]. The cut points for the five components included a waist circumference of 102 cm for men and 88 cm for women, a triglyceride level of 150 mg/dl or higher, a high-density lipoprotein (HDL) cholesterol level lower than 40 mg/dl for the men and lower than 50 mg/dl for the women, a blood pressure of 130/85 mmHg or higher, and a fasting glucose level of 100 mg/dl or higher. Patients were classified as having metabolic syndrome if they fulfilled three or more of these listed criteria thresholds.

All the patients had received the diagnosis of T2DM at least 3 years previously. The mean duration of T2DM was 9.6 ± 4.6 years (range, 3–22 years). Associated criteria included documentation of glycated hemoglobin (HbA1c) exceeding 7.5% for at least 3 months; stable weight, defined as no significant change (>3%) over the 3 months before enrollment; and evidence of stable treatment with oral hypoglycemic therapy, insulin, or both for at least 12 months.

No special criteria were used to determine the two different configurations of the procedures, although it was assumed that the diverted version would be more effective in controlling T2DM. The exclusion criteria specified elderly patients (age, >66 years), previous major upper abdominal surgery, pregnancy, malignant or debilitating