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Original article

Effects of omentectomy in addition to sleeve gastrectomy on the metabolic and inflammatory profiles of obese rats

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Abstract

Background: Visceral obesity has been considered a risk factor for metabolic and cardiovascular complications. In an attempt to reduce the visceral adipose tissue, omentectomy has been proposed to be performed along with bariatric surgery.

Objective: The goal of this study was to evaluate whether omentectomy associated with sleeve gastrectomy (SG) is beneficial to the inflammatory and metabolic profile of rats fed a standard diet (STD) or high-fat diet (HFD).

Setting: University hospital, Brazil.

Methods: For this experiment, male Wistar rats were randomly divided into 6 groups as follows: sham surgery (STD+L or HFD+L), SG alone (STD+SG or HFD+SG), or SG with omentectomy (STD+SGO or HFD+SGO). Anthropometric data and metabolic profiles were evaluated, and the tissue expression of inflammatory markers in the visceral adipose tissue was measured.

Results: In rats with diet-induced obesity treated with SG with or without omentectomy, there was a reduction in weight (HFD+SG: $P < .01$ and HFD+SGO: $P < .05$), adiposity (HFD+SG: $P < .001$ and HFD+SGO: $P < .05$), plasma levels of glucose (HFD+SG: $P < .01$ and HFD+SGO: $P < .01$), plasma levels of C-peptide (HFD+SG: $P < .01$ and HFD+SGO: $P < .001$), plasma levels of insulin (HFD+SG: $P < .05$ and HFD+SGO: $P < .001$), plasma levels of total cholesterol (HFD+SG: $P < .01$ and HFD+SGO: $P < .01$), and tissue expression of TNF-α (HFD+SG: $P < .001$ and HFD+SGO: $P < .01$), but there was no statistically significant difference between the groups in which omentectomy was performed or was not.

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Conclusion: In this study, we did not observe additional beneficial effects due to omentectomy associated with SG in the metabolic profile and tissue expression of inflammatory markers. (Surg Obes Relat Dis 2016;▮:00–00.)

Keywords: Obesity; bariatric surgery; Sleeve gastrectomy; Omentectomy; Weight loss; Inflammation markers

The adipose tissue is a complex organ with endocrine and metabolic activities, from which several factors with local (autocrine and paracrine) and systemic (endocrine) functions are secreted [1]. Obesity is associated with a chronic inflammatory process characterized by the abnormal production of proinflammatory cytokines that activate different signaling pathways. Therefore, the excess of adipose tissue, especially visceral adipose tissue, is correlated with the development of insulin resistance, glucose intolerance, dyslipidemia, hypertension, and a prothrombotic state [2–4]. Thus, resection of the great omentum has been proposed during bariatric surgery to improve the metabolic profile and to maximize the weight loss in obese patients [5]. However, the omentum possesses healing factors (growth, angiogenesis, chemotactic factors, and progenitor cells), and it promotes healing and regeneration of injured tissues when activated [6]. These important properties of the omentum allow it block intraperitoneal inflammatory processes and adhere to it, thereby preventing the development of diffuse peritonitis [7–9].

The inclusion of omentectomy as a part of the bariatric surgery technique remains controversial and questionable. Authors have shown improvement in glycemic homeostasis and the lipid profile when omentectomy is included in the bariatric surgery technique [5,10]. However, other authors have shown that the reduction of visceral adipose tissue achieved by omentectomy is not a useful approach in improving insulin sensitivity and reduction of the cardiometabolic risk factors associated with obesity or type 2 diabetes (T2D) [11,12].

The goal of this study was to determine whether omentectomy associated with sleeve gastrectomy (SG) provides additional beneficial effects to the glycemic profile, lipid profile, and the expression of inflammatory markers in the white adipose tissue of Wistar rats fed a standard diet (STD) or high-fat diet (HFD).

Materials and methods

Animals and diets

Male Wistar rats aged 8 weeks were used for this experiment, and they were randomly divided into 6 groups (10 animals/group), maintained in individual cages, and exposed to a light cycle 12 h/12 h in a temperature of 22 ± 2°C. The rats were treated with STD or HFD for 8 weeks and given ad libitum access to food and water. The STD (Labina; Purina, Wilkes-Barre, PA) is composed of 50.3% carbohydrate, 41.9% protein, and 7.8% fat with a total of 2.18 kcal/1 g of diet [13]. The HFD is composed of 24.5% carbohydrate, 14.4% protein, and 60.9% fat with a total of 5.28 kcal/1 g of diet [13]. All of the HFD components were purchased from Rhoster LTDA (São Paulo, Brazil). After this period, the animals were submitted to surgical treatment as follows: simulated laparotomy (L) (sham surgery), sleeve gastrectomy (SG), and sleeve gastrectomy with omentectomy (SGO). After the second day of the postoperative period, the animals received their respective diets for 4 additional weeks. This study was approved by the Ethics Committee of Experimentation and Animal Welfare of UNIMONTES, Montes Claros, Brazil.

Surgical procedures

The animals were submitted to anesthesia (ketamine and xylazine) administered intraperitoneally after intramuscular application of ceftriaxone for antibiotic prophylaxis. In 2 groups, only the L was performed with the manipulation of the stomach (STD+L and HFD+L). In another 2 groups, SG was performed (STD+SG and HFD+SG). In the last 2 groups, the omentectomy procedure (STD+SGO and HFD+SGO) was performed in addition to the SG. The SG was performed with an 80% resection of the stomach, including complete removal of the gastric fundus and confection of a new gastric tube by manual suture extending from the Hiss angle to the distal portion of the antrum (Figs. 1A–D). For the groups that were subjected to omentectomy, a complete dissection and resection of the whole greater omentum along the greater curvature of the stomach until the duodenum as well as the transverse colon until the spleen was performed (Figs. 2E and F).

Weight, food intake, and tissue collection

The weight, food intake (g/BW), and energy intake (kcal/g BW) were assessed 3 times a week during the pre- and postoperative period. The animals were sacrificed by decapitation with guillotine, and blood samples were collected and centrifuged (3200 rpm for 10 min) for posterior plasma dosages. The following tissues were collected: white adipose tissue (periepididymal, retroperitoneal, and mesenteric) and brown adipose tissue (interscapular). The tissues were weighed, immediately frozen in liquid nitrogen, and stored at −80°C for posterior analysis.