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Original article

Comparison of glucose homeostasis parameters between patients with high and low risk of diabetes at 6 weeks and 6 months after sleeve gastrectomy

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Abstract

Background: The changes in glucose homeostasis after sleeve gastrectomy (SG) for patients with high (HRD) and low risk (LRD) of developing diabetes have not been investigated.

Objective: To compare the glucose homeostasis parameters between patients with HRD and LRD after SG.

Setting: University hospital in Greece.

Methods: Thirteen patients were categorized as HRD (9 females, mean body mass index 46.3 ± 1.6 kg/m^2) and 10 as LRD (8 females, mean body mass index 45.4 ± 1.7 kg/m^2) based on a preoperative 2-hour oral glucose tolerance test (OGTT). OGTT was repeated 6 weeks and 6 months postoperatively. OGTT-derived indices of insulin secretion, insulin sensitivity, and β-cell function (oral disposition index [ODI]) were calculated.

Results: Preoperatively, in the HRD group, fasting and postload glucose levels were higher and the ODIs were lower compared with those in the LRD group. Six weeks postoperatively, glucose levels and ODIs were not different between the 2 groups. However, 6 months postoperatively, the HRD group had demonstrated higher postload glucose levels and lower ODI (0–30) and ODI (0–120) compared with the LRD group. Six weeks postoperatively, insulin levels, early insulin secretion, and insulin resistance indices were decreased compared with preoperative levels only in the HRD group. Six months postoperatively, ODIs and insulin sensitivity indices improved in both groups compared with baseline.

Conclusion: Six months after SG, glucose levels and ODIs improved for both HRD and LRD patients; however, postprandial glucose levels and ODI (0–30) and ODI (0–120) in HRD patients did not return to LRD levels. Moreover, during the first 6 postoperative weeks, the changes in glucose homeostasis parameters compared with preoperative levels were different for HRD and LRD patients. (Surg Obes Relat Dis 2017;▮:00–00.)

Keywords: Sleeve gastrectomy; Bariatric surgery; Oral glucose tolerance test; High risk of developing diabetes; Low risk of developing diabetes

Sleeve gastrectomy (SG) is currently one of the most commonly performed bariatric procedures worldwide [1] and can result in considerable and sustained weight loss

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[2,3]. Moreover, SG can restore euglycemia from the early postoperative period in patients with impaired fasting glycemia (IFG), impaired glucose tolerance (IGT), or type 2 diabetes (T2D) [4,5]. Interestingly, studies in patients with T2D have shown that SG also can improve first phase insulin secretion and insulin sensitivity immediately postoperatively [6], suggesting that β-cell function may be restored in these patients, at least partially, during the early postoperative period after SG. However, relatively high percentages of diabetes recurrence after SG have been reported in the literature [7,8], and a small percentage of patients without diabetes preoperatively (approximately 3%–4%) will develop diabetes within a few years of undergoing SG. These observations suggest that glucose homeostasis is not always fully restored after SG [9].

Regarding patients with IFG and IGT, a recent study reported that fasting and 2-hour post–oral glucose tolerance test (OGTT) glucose levels were restored to euglycemic values in all patients 6 months after SG [4]. Nevertheless, whether β-cell function and other parameters of glucose homeostasis in patients with high risk of developing diabetes (HRD) are restored to the levels of patients with low risk of developing diabetes (LRD) after SG has not been investigated.

The aims of this study were to investigate the changes in glucose homeostasis at 6 weeks and 6 months after SG in patients with HRD and LRD and to determine whether glucose levels, β-cell function, and insulin sensitivity in patients with HRD are restored to the levels of patients with LRD at these time points.

Methods

Definition of high and low risk of developing diabetes

For this study, HRD patients were categorized as those with fasting glucose levels <126 mg/dL and either 1-hour postload glucose levels ≥ 155 mg/dL or 2-hour postload glucose levels 140–199 mg/dL. On the other hand, LRD patients were categorized as those with fasting glucose <100 mg/dL and 1-hour postload glucose <155 mg/dL and 2-hour postload glucose <140 mg/dL.

These definitions were based on previous studies that have suggested that patients with IGT (defined as fasting glucose <126 mg/dL and 2-hour postload glucose 140–199 mg/dL), patients with normal glucose tolerance (NGT, defined as fasting glucose <100 mg/dL and 2-hour postload glucose <140 mg/dL) and 1-hour postload glucose ≥ 155 mg/dL, and patients with IFG (defined as fasting glucose between 100–125 mg/dL and 2-hour glucose <140 mg/dL) and 1-hour postload glucose ≥ 155 mg/dL are at higher risk of developing diabetes compared with patients with NGT and 1-hour postload glucose <155 mg/dL [10–12].

Patients with IFG and 1-hour postload glucose <155 mg/dL were excluded from the analysis because it is not clear whether they have significantly higher risk of developing diabetes compared with patients with NGT and 1-hour postload glucose <155 mg/dL [11].

Study participants and design

The study was a retrospective analysis of prospectively collected data. All patients were recruited between March 2009 and June 2010 as part of a previous study investigating the incidence of dumping syndrome and hypoglycemia after SG [13]. The study was conducted in compliance with the Declaration of Helsinki. Written consent was obtained from each patient, and the institutional review board approved the study.

The inclusion criteria for the study were body mass index (BMI) ≥ 40 kg/m^2 (or BMI ≥ 35 kg/m^2 for patients with obesity related co-morbidities), age ≥ 18 years, and patients without active psychiatric disease. Exclusion criteria for this analysis were uncontrolled drug or alcohol dependency; severely impaired intellectual capacity; previous bariatric surgery; previous diagnosis of diabetes; baseline glycated hemoglobin $\geq 6.5\%$; and the use of oral glucose–lowering medications, glucagon-like peptide 1 receptor analogs, insulin, oral steroids, or beta-blockers. Patients also were excluded based on their preoperative 2-hour OGTT, whether their fasting glucose was ≥ 126 mg/dL or the 2-hour postload glucose levels were ≥ 200 mg/dL, or whether they were categorized as IFG with 1-hour postload glucose <155 mg/dL. Overall, 23 patients who fulfilled the inclusion criteria and completed an OGTT 6 weeks and 6 months postoperatively were included in the analysis.

Patients arrived at the hospital in the morning, after an overnight fast, and an intravenous cannula was inserted. A 2-hour OGTT with 75 g of glucose (150 mL of non-carbonated glucose drink) was performed. Blood samples were collected at 0 (before oral glucose intake) and at 30, 60, 90, and 120 minutes after oral glucose intake to measure glucose and insulin levels. All preoperative OGTTs were performed 4 to 6 weeks before the surgery during the preoperative assessment.

The preoperative medications of the patients are presented in eTable 1. Patients were asked not to take any medications on the morning of the preoperative and postoperative OGTTs. Blood pressure and cholesterol-lowering medications were stopped during the first months after the SG. Moreover, patients with symptoms of gastroesophageal reflux were advised to take proton pump inhibitors during the postoperative period.

All patients underwent SG at a university hospital in Greece. The SG was performed as previously described [14], with dissection starting approximately 5 cm from the pylorus and extending up to the left crus using a 36F bougie to create the gastric sleeve. All patients received the same