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Comparative study between effect of sleeve gastrectomy and mini-gastric bypass on type 2 diabetes mellitus

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ABSTRACT

Objective: Comparative study between the effect of LSG and LMGB on patients with type 2 DM and BMI $\geq 35\ kg/m^2$.
Study design: A prospective comparative study which included 40 obese patients with type 2 DM(20 patients were operated for laparoscopic sleeve gastrectomy (LSG) and 20 patients for laparoscopic mini-gastric bypass (LMGB)), with mean age at LSG group 42.95 ± 7.63 with range of 31–59 years, at LMGB group was 42.9 ± 6.17 with range of 34–58 years.
Results: In SG cases; complete remission occurred in 11 patients with percentage of 55% and failure of remission occurred in 9 patients with percentage of 45%. No cases developed partial remission in SG cases. In MGB cases; 15 developed diabetic remission with percentage of 75% (11 (55%) patients developed complete remission, 4 (20%) patients developed partial remission). Failure of remission occurs in 5 patients in MGB cases with percentage of 25%.
Conclusion: Based on our results, LSG and LMGB are efficient operations for reducing weight in morbidly obese patients and also in diabetic control in T2DM. LMGB might be superior to LSG in %EWL and T2DM remission after 1.5 year follow up.

1. Introduction

Obesity became an epidemic disease. Physical, psychological, and economic complications are associated with obesity which leads to difficulty in caring of obese patients by physicians [1]. Globally, Type 2 DM spreads also in parallel to obesity as more than 171 million people are affected worldwide, causing ~3 million deaths per year [2].

Obesity and metabolic syndrome are associated with multiple complications among them type 2 DM, and there is a great evidence that this can be managed with bariatric surgery [3]. Patients with BMI $\geq 40\ kg/m^2$ or with BMI $\geq 35\ kg/m^2$ plus comorbid conditions are candidate for bariatric or metabolic surgery as weight loss that will happen can improve co-morbidities [4].

Insulin resistance is the main problem in metabolic syndrome that leads to type 2 DM. Decreased insulin sensitivity and impaired β-cell function are the agents in pathogenesis of type 2 DM and insulin resistance is the link between obesity and type 2 DM. The manifestations of insulin resistance are decreased transport and metabolism of insulin-stimulated glucose in adipocytes and skeletal muscle and impaired suppression of hepatic glucose output [5].

The most important factor in development of insulin resistance is presence of visceral obesity and this occurs due to secretion of certain inflammatory cytokines, such as IL-6, TNF-alpha, TGF b1 and monocyte chemotactic protein-1 by the resident fat macrophages. Also, increased incidence of cardiovascular diseases associated with obesity is explained by the same inflammatory cytokines [6].

Occurrence of type 2 DM with obesity is not related to degree of obesity only, but also distribution of fat accumulation has an important role, as increased upper body fat including visceral adiposity which is explained by increased abdominal girth or waist-to hip ratio leads to metabolic syndrome type 2DM and cardiovascular disease [7].

In a recent systematic review and meta-analysis comparing between effect of bariatric surgery and non-surgical treatment for obesity, there is greater weight loss and higher remission rates of type 2 diabetes and greater reductions in use of anti-diabetic, antihypertensive and lipid lowering drugs after bariatric surgery [8].Bariatric surgery can also decrease

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diabetes-related morbidity and mortality and give diabetic patients long period of DM control [9].

Indications for bariatric surgery include a BMI of 40 kg/m^2 or higher, or a BMI between 35 and 40 kg/m^2 with at least two obesity-related comorbidities, According to National Institutes of Health guidelines. DM is the most important comorbidity that determines the risk of surgery, so bariatric surgery can be done for any obese patient with BMI $\geq$ 35 kg/m^{2}withtype 2 DM who failed to lose weight with other weight-control approaches [10].

Both observational and randomized controlled trials showed that type 2 DM remission and glycemic control occurred more with metabolic surgery than with medical therapy. So bariatric surgery can be offered as a treatment option for type 2 DM in mild obese patients as it leads to reduction of morbidity and mortality for long time [11].

Objective: comparative study between the effect of LSG and LMGB on patients with type 2 DM and BMI $\geq$ 35 kg/m^2.

2. Patients and methods

2.1. Study design and population

A prospective comparative study which included 40 obese patients (BMI $\geq$ 35 kg/m^2) with type 2 DMwith failure of other methods of weight loss and medical treatment (20 patients were operated for laparoscopic sleeve gastrectomy (LSG) and 20 patients for laparoscopic mini-gastric bypass (LMGB)), with mean age at LSG group 42.95 $\pm$ 7.63 with range of 31–59 years, at LMGB group was 42.9 $\pm$ 6.17 with range of 34–58 years. These patients were enrolled in a combined prospective study and had a retrospectively gathered outcome analysis at the department of surgery, Al-Azhar University Hospitals from March 2016 to March 2018.

Inclusion criteria :(1) Adult age groups (20–60 years old), (2) Patients with BMI $\geq$ 35 kg/m^2, (3) Patients with type 2 DM.

Exclusion criteria :(1) Patients with BMI < 35 kg/m^2, (2) Non diabetic patients, (3) Patients with type I DM.

2.2. Study strategy

Ethical approval was taken from Al-Azhar University ethical committee and written consent was taken from every patient after explanation of all details of the operation, advantages, disadvantages, diet habits after surgery, realistic expectations and with the possibility of conversion to open surgery and all the possible intra-operative, early and late post-operative complications.

All patients were admitted to general surgery department, detailed medical history was taken, and complete examination and investigations were obtained (complete blood count, blood sugar, HbA1c, bleeding profile, renal functions, liver functions, thyroid functions, pulmonary functions, Abdomino-pelvic U/S, ECG Echocardiography and venous duplex. Operations were done laparoscopically. Patients were followed up for 18 months post operatively.

Intervention: laparoscopic sleeve gastrectomy and laparoscopic mini-gastric bypass. Standardized surgical technique for each LSG and LMGB was used:

For LSG, mobilization of the gastric greater curve began 6 cm proximal to the pylorus, and continued to the angle of His with importance accorded to the total exposure of the left crural pillar. Gastric resection using generally five to seven vertical 60 mm staple cartridges over a 36 French bougie (Fig. 1).

For LMGB, the gastric tube was created from the angle of the lesser curvature to the left crural pillar using generally four to five vertical 60 mm staple cartridges over a 36 French bougie. 200 cm downstream the angle of Treitz, an ante-colic termino-lateral gastrojejunostomy is performed using a posterior 45-mm roticulator linear stapler and an anterior running suture or a continuous manual suture with an absorbable suture (Fig. 2). For both procedures, absence of gastric leak was verified by introducing methylene blue through a nasogastric tube at the end of the operation. On day 2, patients routinely underwent standard upper gastrointestinal tract swallow imaging. Patients were allowed to drink if no complication was observed. Patients were usually discharged on day 3 or 4.

Follow up: Patients were scheduled for follow up visits at 1, 3, 6, 12, 18 months. Measurements of blood sugar, HbA1c, body weight, BMI and medications taken for DM were done in each visit.

2.3. Statistical analysis

Data were collected, revised, coded and entered to the statistical analysis of social science (SPSS) version 23. The qualitative data were presented as number and percentages while quantitative data were presented as mean $\pm$ standard deviation and ranges when the data were parametric while data with non-parametric distribution were presented as median with inter-quartile range (IQR). The comparisons between two groups with qualitative data were done by using Chi-square test.

The comparison between two groups with quantitative data and parametric distribution were done by using Independent *t*-test while data with non-parametric distribution were done by using Mann-Whitney test. The confidence interval was set to 95% and the margin of error accepted was set to 5%. P-value was calculated.

3. Results

3.1. Participant characteristics

The mean $\pm$ SD age was at SG group 42.95 $\pm$ 7.63 with range of 31–59 years, at MGB group was 42.9 $\pm$ 6.17 with range of

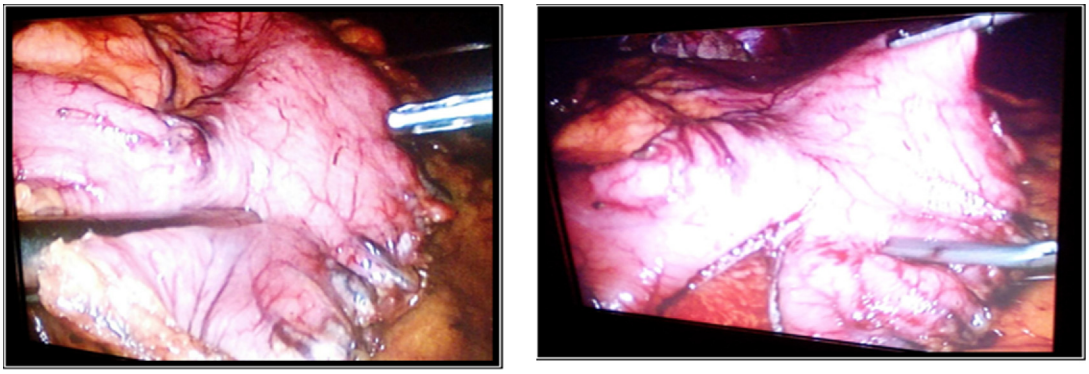

Fig. 1. Gastric resection during LSG operation.

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