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ORIGINAL ARTICLE

Remission of Type 2 Diabetes Mellitus after Laparoscopic Sleeve Gastrectomy

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ABSTRACT

Introduction: Type 2 diabetes mellitus (T2DM) comprises 90% of diabetics and is largely the result of excess body weight. There is rising evidence in the literature to suggest that laparoscopic sleeve gastrectomy (LSG) produces effective weight loss and improves obesity-related comorbidities, such as T2DM. The purpose of the study is to observe the effectiveness of LSG in the remission of T2DM.

Materials and methods: A retrospective study of 107 diabetic obese patients who underwent LSG at Alamiri Hospital, from October 2008 to 2012 was conducted. The pre- and postoperative diabetic status, body mass index, and percent excess weight loss (%EWL) of the patients were retrieved and analyzed.

Results: The mean age of the patients was 42 years ± 10.4 and 68% were females. Median preoperative BMI was 46 kg/m^2 (30-87) and median postoperative follow-up period was 18 (2-48) months. Pre- and postoperative fasting blood glucose and HbA1C were measured. Resolution and improvement of T2DM was 53.3% (n = 57) and 38.3% (n = 41), respectively. The %EWL was 72% at 1 year and 73% at 4 years and median postoperative BMI was 33 kg/m^2 (20-61). Duration based analysis showed that most of the resolved patients had diabetes for less than 5 years.

Conclusion: LSG resulted in total remission of T2DM in more than half of the patients and is more effective for the treatment of patients with short-term duration of the disease.

Keywords: Bariatric surgery, Sleeve gastrectomy, Diabetes mellitus.

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INTRODUCTION

Obesity has recently gained the attention of many physicians over the world as the numerous morbidities associated with a high body mass index (BMI) have become evident. Over a span of 20 years, namely between 1980 and 2008, the recorded percentage of overweight adults has reached 1.4 billion people worldwide (35% of the world's population), of those 200 million men and 300 million women are considered obese (11% of the population).[1] When in view of the health hazards linked to obesity, these numbers are somber. They translate as health risks, such as diabetes mellitus type 2 (T2DM), insulin resistance, heart disease, dyslipidemia, hypertension, stroke, venous thrombus formation, osteoarthritis, and psychosocial effects.[2] Furthermore, all-cause mortality and cardiovascular disease related mortality are particularly increased in the overweight populace.[3]

As of 2011 bariatric surgery is formally considered a component of the early management of T2DM to decelerate the progression of the disease and, thereby reduce mortality, morbidity and cost of treatment, thereby improving the quality of life.[4] The exact influential mechanism of bariatric surgery on glucose metabolism is uncertain; however, it is thought to be secondary to the effects of hormones, principally: ghrelin, peptide YY (PYY3-36), and glucagon-like peptide 1 (GLP-1).[5]

It remains to be said that despite this, bariatric surgery is usually only considered once medical therapy has failed or glycemic control cannot be achieved adequately. In this study, we aim to observe the effectiveness of laparoscopic sleeve gastrectomy (LSG) in the management and definite treatment of T2DM.

MATERIALS AND METHODS

A retrospective study was conducted of the patients who underwent LSG at Al-Amiri Hospital, Kuwait from October 2008 to December 2012. From those, the diabetic patients were isolated and their files with pre- and postoperative laboratory investigations were retrieved. LSG was performed in a standard split-leg French position using five laparoscopic ports. Devascularization of the greater curvature of the stomach was carried out starting from 4 to 6 cm from the pylorus and up to the angle of His. A 36-Fr calibrating bougie was then passed through the stomach to the duodenum before creating the gastric sleeve. The sleeve was performed with a linear laparoscopic stapler using green or black cartridges

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for the antrum and blue cartridges for the body and fundus, aiming for a final gastric pouch size of 100 ml. The calibrating bougie was then pulled proximally and 100 ml of methylene blue were injected through it to assess for leak. No intrabdominal drains were placed.

Diabetes was defined in accordance with the International Diabetes Federation as a fasting blood glucose (FBG) level of more than 7.0 mmol/l, and HBA1C more than 6.5%. The primary outcome measures were T2DM resolution, defined as FBG of less than 7 mmol/l and HBA1C less than 6.5% in the absence of any hypoglycemic medications, and T2DM improvement, defined as a reduction in the dosage of hypoglycemic medications. The resolution and improvement of diabetes were also grouped and analyzed in terms of time since T2DM onset and treatment type: diet, oral hypoglycemic agents (OHA), insulin, and insulin + OHA. Secondary outcomes measures included change in FBG and HBA1C levels pre and postoperative, percent excess weight loss (%EWL), and change in BMI.

The study was approved by the Kuwait Institute for Medical Specialization and Kuwait Ministry of Health ethical committees. Statistical analysis of the data was carried out using SPSS software. Statistical significance was calculated using Fisher's exact test and was set at a p-value less than 0.05.

RESULTS

The data from a total of 1,202 patients who underwent LSG at Al-Amiri Hospital was retrieved and analyzed. A total of 185 (15.4%) patients were found to be diabetic, 107 of whom had the required laboratory investigations and anthropomorphic data available and were used for this study. The mean age of the diabetic patients was 42 ± 10.4 years and 127 patients (68.8%) were females. Median preoperative BMI was 46 kg/m^2 (30-87) and median postoperative follow-up period was 18 months (2-48).

Remission of T2DM was seen in 53.3% (n = 57) of the patients and improvement of T2DM was seen in 38.3% (n = 41). Median pre- and postoperative FBG was 11 mmol/l (4-27) and 6 mmol/l (3-18), respectively. Similarly, median HBA1C levels decreased by 2.9% between the pre- and postoperative period, from 9.5% (6-17) to 6.6% (3-11). Diabetes status during interval follow-up periods is depicted in Table 1. No significant difference was found in T2DM remission and improvement in terms of patient gender (p = 0.985) and age (p = 0.933).

The median preoperative duration of diabetes among the patients was 9 years (0.1-24). Duration based analysis showed an inverse relationship between the duration of preoperative diabetes and likelihood of diabetes remission postoperatively (p < 0.001). Most of the patients in whom diabetes resolved had the disease for less than 5 years, with the best results found in those with duration of T2DM of 1-3 years (Table 2).

Preoperatively, 2 patients were managed by pure diet control, 68 were taking OHA, 15 were on insulin therapy, and 13 with a combination of insulin + OHA. In terms of treatment based outcomes, patients who were on diet control and OHA showed better remission of the disease than those on insulin and OHA + insulin (Table 3). The difference between them however lacked statistical significance.

Median %EWL was 60% (10-239) and was found to be 72% at 1 year and 73% at 4 years (Graph 1). A significant association was found between the %EWL and complete remission compared to just improvement of T2DM (Graph 2). The median postoperative BMI was 33 kg/m^2 (20-61).

DISCUSSION

The findings of this study clearly point to the fact that LSG can play a significant role in managing T2DM. The fact that the vast majority (91.6%) of patients showed either complete remission or improvement of the disease is in keeping with the emerging literature focusing on LSG as a potential option for the management of diabetes. Most current studies comprise of a substantially small patient population but show significant improvement in blood glucose levels, almost reaching near normal figures in known T2DM.

In a 2010 systemic review of 27 studies with 673 patients, LSG was shown to resolve diabetes in 66.2% of the subjects, with 97.1% experiencing resolution or improvement.[6] The drop in baseline FBG (11 mmol/l to 6 mmol/l)

Table 1: Diabetes status and percentage excess weight loss during interval follow-up periods

Post-op follow-up interval	*n (%)*	*Type 2 diabetes status*			*% EWL*
		Not improved	*Improved*	*Resolved*	
6 months	6 (5.6)	0 (0)	2 (33.3)	4 (66.7)	54
12 months	22 (20.6)	2 (9.1)	7 (31.8)	13 (59.1)	72
18 months	34 (31.8)	3 (8.8)	17 (50.0)	14 (41.2)	75
24 months	13 (12.1)	1 (7.7)	1 (7.7)	11 (84.6)	75
36 months	27 (25.2)	3 (11.1)	13 (48.1)	11 (40.7)	65
48 months	5 (4.7)	0 (0)	1 (20)	4 (80)	73

p = 0.232 (Fisher's exact test)

Table 2: Duration-based outcome of T2DM after LSG

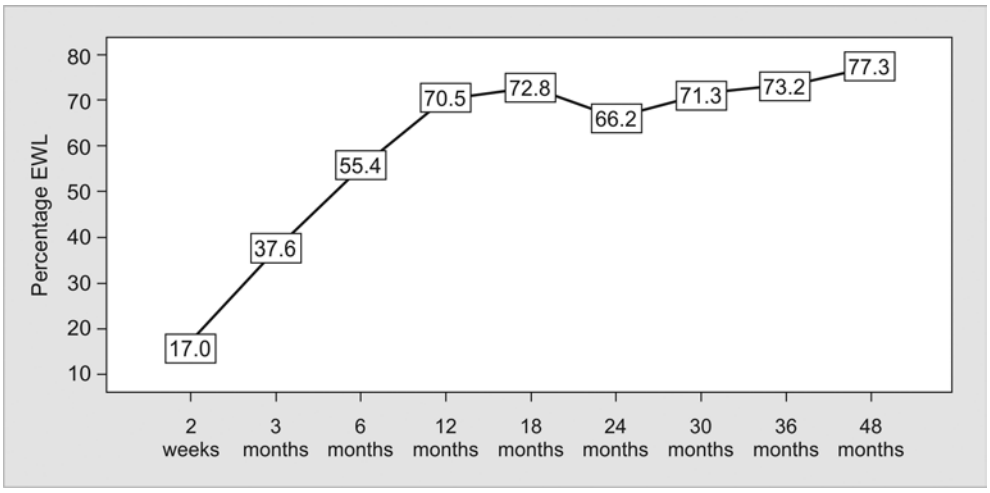
Duration of DM in years (pre-op)	*Total n (%)*	*Not improved n (%)*	*Improved n (%)*	*Resolved n (%)*
< 1	4 (5.3)	0 (0)	1 (25.0)	3 (75.0)
1-3	19 (25.0)	1 (5.3)	3 (15.8)	15 (78.9)
3-5	16 (21.1)	1 (6.3)	4 (25.0)	11 (68.8)
5-10	20 (25.8)	0 (0)	9 (45.0)	11 (55.0)
> 10	17 (23.7)	1 (5.9)	14 (82.4)	2 (11.8)

p = 0.001 (Fisher's exact test)

Table 3: Treatment-based outcome of T2DM after LSG

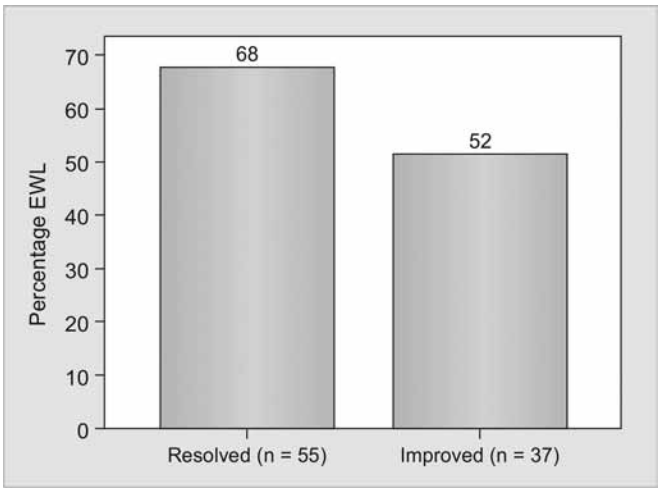
	Treatment				
Results	*Diet (%)*	*OHA (%)*	*Insulin (%)*	*(OHA + Insulin) (%)*	*Total (%)*
Resolved	2 (100)	43 (63.2)	6 (40)	5 (38.5)	56 (57.1)
Improved	0 (0)	19 (27.9)	9 (60)	7 (53.8)	35 (35.7)
Not improved	0 (0)	6 (8.8)	0 (0)	1 (7.7)	7 (7.1)
Total	2 (2.0)	68 (69.4)	15 (15.3)	13 (13.3)	98 (100)

p > 0.05 (Fisher's exact test)



Graph 1: Percentage of EWL over first 48 months

and improvement in HBA1C level (9.5% to 6.6%) found in this study is also in keeping with that of the systemic review (FBG drop from 10 mmol/l to 6.6 mmol/l, and HBA1C from 7.9 to 6.2%). Newer publications also point to the same findings, with Abbatini et al observing an 80.9% cure of diabetes in just 3.3 months after LSG.[7] Another study by Wei-Jei Lee et al showed that out of 20 patients the median reduction of HbA1c was from 10.1 to 7.1%[8] and a net HBA1C decrease of 2.175% was observed in another.[9] Furthermore, an interesting study by Omana et al even showed a 100% resolution and improvement of T2DM after LSG.[10]



Graph 2: Percentage of EWL and T2DM resolution *vs* improvement only, p = 0.009 (Fisher's exact test)

Observing factors, such as disease duration and treatment regimes, might help in analyzing which patients can benefit the most form surgery and better predict outcomes.[11] The finding that patients with a duration of diabetes less than 5 years preoperatively showed a significantly superior resolution from the disease further proves this point. In addition, the interesting finding that there was no statistically significant difference between T2DM resolution among the different treatment regimens proposes that LSG might prove to treat the disease regardless of the severity.

There is no longer speculation that bariatric surgery is fast becoming a viable treatment option for T2DM, with recent large scale randomized control trials showing its superiority over traditional medical therapy.[12] However, there is still a lack of large-scale studies observing LSG in particular when it comes to diabetes resolution. This is due to the fact that Roux-en-Y gastric bypass (RYGB) remains the gold standard bariatric procedure, with a T2DM remission rate reaching as high as 60%.[13,14] However, recent evidence has been emerging showing no significant difference between LSG and RYGB in terms of efficacy in treating T2DM, with both procedures showing comparable results in diabetes control.[15,16] LSG, though considered by many as a novel procedure, continues to show its efficacy, not only in the treatment of the obesity pandemic, but as a potential cure for diabetes.

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