

Role of Laparoscopic Sleeve Gastrectomy (LSG) for Management of Obese Patients with Type 2 Diabetes Mellitus- Single Center Study

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Abstract

Background: Laparoscopic Sleeve Gastrectomy (LSG) has become one of the commonest bariatric procedures done for management of obese patients. Although Laparoscopic Roux-en-Y Gastric Bypass (LRYGB) has well documented positive clinical influence on type 2 diabetes, the role of LSG in diabetes treatment is still questionable. In this study we want to present our experience in management of diabetes with LSG.

Methods: Between September 2014 and June 2016, fifty patients were enrolled in our prospective study at Department of Surgery, Ain Shams University assessing the effect of LSG on morbid obese patients with Type 2 Diabetes Mellitus (T2DM). All patients were monitored for weight loss and improvement of T2DM markers; Fasting Blood Glucose (FBG), Postprandial Plasma Glucose (PPG) and HbA1c at 3, 6 and 12 months follow-up post-operative.

Results: There was a highly significant difference between BMI at baseline and at 12 months after operation, resolution of type 2 diabetes mellitus occurred in 70% of patients evident by normalization of HbA1c (5.6%) and stopping all medications, and improvement occurred in 10% of patients evident by HbA1c value of 6.5% without medication.

Conclusion: Laparoscopic sleeve gastrectomy is simple and effective surgical procedure to achieve a significant weight loss and control of type 2 diabetes mellitus which starts in the early post-operative period. There is significant reduction in the diabetes medications hence the cost of diabetes treatment and improvement of the quality of life.

Key Words: Sleeve gastrectomy – Morbid obesity – Type 2 diabetes mellitus.

Introduction

OBESITY prevalence is increasing around the world, and now around a billion adults are obese [1]. Type 2 diabetes and glucose metabolism abnormalities are one of the most important effects of morbid obesity which lead to severe and chronic reduction in quality of health. High effectiveness

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of bariatric therapy for weight reduction and treatment of comorbidities has been proven in numerous studies [2]. Diabetes mellitus is a chronic disease, that has reached epidemic proportions worldwide and its prevalence continues to increase. The prevalence of diabetes for all age-groups worldwide was estimated to be 2.8% in 2000 and 4.4% in 2030. In the year 2000 there were approximately 171 million people aged 35 to 64 years with diabetes throughout the world; by 2030, there will be 366 million [3]. The relationship between obesity and Type 2 Diabetes Mellitus (T2DM) is well known, and up to one-third of patients presenting for bariatric operation are known to be diabetic [4]. There is increased risk of T2DM with increase in Body Mass Index (BMI) from 2% among those with of BMI 25 to 29.9kg/m² to 13% if BMI is >35kg/m². Patients with a BMI >35kg/m² have 40 times greater risk than people with lower BMI [5]. In recent years, Laparoscopic Sleeve Gastrectomy (LSG) has become one of the most commonly used primary bariatric procedure for morbid obesity [6]. Numerous authors strive to prove that effect of LSG on type 2 diabetes treatment is as good as Laparoscopic Roux-en-Y Gastric Bypass (LRYGB), which was known as a “gold standard” for diabetic patients. Potential mechanisms of diabetes remission and improvement in glucose homeostasis after LSG are the main topic of recent studies, yet its results are still unclear [7]. In this study we want to present our experience in management of diabetes with LSG in obese patients.

Patients and Methods

This study was carried out in Ain Shams University Hospitals during the period starting from September 2014, till June 2016. This study was designed as a prospective interventional study, to evaluate the effect of Laparoscopic Sleeve Gastrectomy on obese patients with type 2 diabetes

mellitus. Fifty patients were included in this study. This study included both males (n=12) and females (n=38), aged ≥ 18 year old, with BMI $\geq 35\text{kg/m}^2$, associated with obesity related co-morbidities (Table 1) (including type 2 diabetes mellitus); (where diabetes mellitus is diagnosed when: Symptoms of diabetes and a random blood sugar of 200 mg/dl (11.1 mmol/L) or higher, or a fasting blood sugar level of 126mg/dl (7.0mmol/L) or higher, or a HbA1c of 6.5 percent or higher), or who failed ≥ 6 months of organized non-surgical weight loss attempts.

Operative technique:

The operations were performed laparoscopically under general anesthesia using the French position (the surgeon standing between the patient's legs). Each procedure required 5 trocars. Pneumoperitoneum was established by visi-port just above and to the left of the umbilicus and maintained at a pressure of 18mmHg. Dissection started on the greater curvature, 4cm from the pylorus. The gastrocolic ligament along the greater curvature of the stomach was opened using an impedance coagulator (LigaSure Blunt Tip Laparoscopic Sealer/Divider) and was freed as far as the cardio esophageal junction at the root of the left pillar of the hiatus. The short gastric vessels close to the spleen were carefully coagulated separately. A calibration tube using a 36-F was then inserted transorally into the stomach by the anesthesiologist and directed toward the antrum 4cm from the pylorus. A laparoscopic linear stapler was used to divide the stomach parallel to the orogastric tube along the lesser curvature. The instrument was fired, reloaded, and the procedure was repeated; a maximum 6 cartridges were used to staple the antrum, the body, and fundus of the stomach.

Outcome:

Resolution of T2DM were defined as a HbA1C value of 5.6% and improvement as a HbA1 C value of 6.5% for both without the use of hypoglycemic oral medication or insulin at 12 months follow-up while failure was defined as persistence of symptoms of T2DM and failure to achieve adequate glycemic control without medications.

Statistical analysis:

The collected data was revised, coded, tabulated and introduced to a PC using Statistical package for Social Science (IBM Corp. Released 2011. IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp). Data was presented and suitable analysis was done according to the type of data obtained for each parameter.

Table (1): Description of personal and medical characteristics among study cases.

	Mean	\pm SD	Min	Max	Median	IQR*
Age	35.22	8.33	18.0	60.0	35.5	29 14
Duration of T2DM (years)	9.82	9.23	1.00	40.0	6.0	3 15
Sex:						
• Male (n %)	12	24.0%				
• Female (n %)	38	76.0%				
Co-morbidities:						
• None (n %)	15	30.0%				
• HTN (n %)	2	4.0%				
• Dyslipidaemia (n %)	22	44.0%				
• HTN/dyslipidaemia (n %)	11	22.0%				

*: Interquartile range.

Results

For the study cases, the mean height was $172.18 \pm 6.35\text{cm}$. The mean baseline weight was $126.84 \pm 9.93\text{kg}$. On follow-up, the mean weight was $107.86 \pm 7.85\text{kg}$, $101.34 \pm 7.68\text{kg}$, and $94.26 \pm 6.64\text{kg}$, for the following 3, 6, and 12 months respectively. The mean BMI was 42.77 ± 2.39 , and 31.77 ± 0.98 for the baseline and the 12 months values respectively. Therefore, the mean EWL % was 61.48 ± 0.99 (Table 2).

In our study we observed a dramatic improvement in the biomarkers of diabetes mellitus through our follow-up at 3, 6 and 12 months post-operative via measuring FBG, PPG and HbA1c with no statistical difference as regard other co-morbidities.

As regard the mean FPG, it was $161.92 \pm 16.25\text{mg/dl}$, $127.46 \pm 15.59\text{mg/dl}$, $117.20 \pm 19.02\text{mg/dl}$, and $102.84 \pm 25.17\text{mg/dl}$, for baseline, 3, 6, and 12 months respectively. While the mean PPG, it was $232.62 \pm 19.89\text{mg/dl}$, $178.94 \pm 23.16\text{mg/dl}$, $167.78 \pm 23.90\text{mg/dl}$, and $149.54 \pm 32.74\text{mg/dl}$, for baseline, 3, 6, and 12 months respectively.

As regard the mean HbA1c, it was $9.18 \pm 1.56\%$, $7.92 \pm 1.72\%$, $6.83 \pm 1.69\%$, and $5.93 \pm 1.39\%$, for baseline, 3, 6, and 12 months respectively. As shown in (Table 4), 10 (20%) of the study group, showed no change as regards diabetic profile. However, 5 (10%) patients were improved, and 35 (70%) patients were cured (Table 3).

Table (2): Description of anthropometric measures at baseline and at follow-up among study cases.

	Mean	\pm SD	Minimum	Maximum
Height (cm)	172.18	6.35	163.00	188.00
Weight (kg) baseline	126.84	9.93	108.00	156.00
Weight after 3 months	107.86	7.85	93.00	130.00
Weight after 6 months	101.34	7.68	87.00	124.00
Weight after 12 months	94.26	6.64	82.00	113.00
BMI baseline	42.77	2.39	39.71	50.93
BMI after 12 months	31.77	0.98	30.45	34.89
EWL %	61.48	0.99	60.00	63.00

Table (3): Description of blood glucose measures at baseline and at follow-up among study cases.

	Mean	± SD	Minimum	Maximum
FPG baseline	161.92	16.25	131.00	194.00
FPG after 3 months	127.46	15.59	89.00	154.00
FPG after 6 months	117.20	19.02	76.00	159.00
FPG after 12 months	102.84	25.17	65.00	167.00
PPG baseline	232.62	19.89	202.00	268.00
PPG after 3 months	178.94	23.16	132.00	241.00
PPG after 6 months	167.78	23.90	132.00	233.00
PPG after 12 months	149.54	32.74	103.00	277.00
HbA1c baseline	9.18	1.56	6.60	11.90
Hb A1c after 3 months	7.92	1.72	5.40	11.80
Hb A1c after 6 months	6.83	1.69	5.50	12.30
Hb A1c after 12 months	5.93	1.39	5.10	10.30

DM:

No change (n %)	10	20.0%
Improved (n %)	5	10.0%
Cured (n %)	35	70.0%

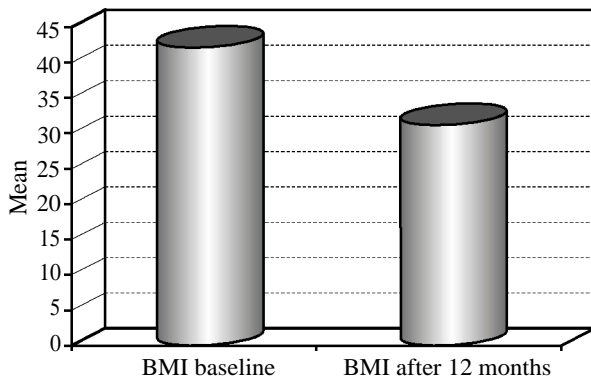


Chart (1): BMI at baseline and 12 months.

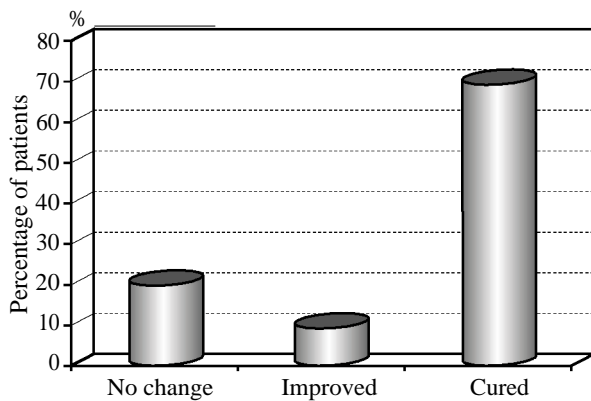


Chart (2): T2DM status on follow-up.

Discussion

LRYGB and LSG are the most common bariatric surgeries worldwide. The role of bariatric surgery in management of morbid obesity is well established. The effect of bariatric surgeries on weight loss is important as well as its impact on co-morbidities, especially type 2 diabetes. In the age of bariatric surgery, type 2 diabetes can be

viewed as a curable disease. Bariatric surgery has been confirmed to be beneficial in remission of abnormalities in glucose homeostasis [8].

In opposition to LRYGB, mechanisms of diabetes remission after LSG are not well-defined. The Glucagon-Like Peptide 1 (GLP-1) play the key-role in changes of glucose metabolism and it is responsible for improvement of glucose homeostasis after LRYGB. After LSG the level of GLP-1 rises as well, thus it has been suggested to contribute to potential improvements in diabetes remission [9]. In previous studies we noticed the same relations between gut hormones after LSG [10].

Revising the literature, the rate of loss of excess weight at one year is 62%, as reported by Todkar et al., [11], and 77.1% as reported by Wang et al., [12]. The mean EWL% in our study is 61.48±0.99 at 12 months, which is significant and is consistent with the other studies. Similarly, the mean BMI also reduced substantially (31.77kg/m²) in accordance with the earlier studies, (27.9kg/m², as reported by Wang et al., several studies show the difference in therapeutic effects for different BMIs, where patients with lower BMI (<40kg/m²) can achieve a higher % of EWL than patients with higher BMI (>40kg/m²) [12]. It is expected that the loss of excess weight may be even more if patients follow the nutritional guidelines strictly, which is high-protein, low- calorie diet and regular exercise [13].

Significant improvement of plasma glucose level control, and/or resolution of type 2 diabetes mellitus (as evident by diabetic markers like fasting as well as post prandial plasma glucose levels, and HbA1c), is commonly observed after LSG [14]. After 12 months, a remission of type 2 diabetes mellitus after LSG was 57.7% as reported by Peterli et al., [15], 80.9% as reported by Abbatini et al., [16], 78.6% as reported by Yang et al., [17], and 84.6% as reported by Vidal et al., [19]. In our study, resolution of type 2 diabetes mellitus occurred in 70% of patients (n=35), and improvement occurred in 10% of patients (n=5).

Abbatini et al., reported a mean FPG level of 195mg/dl and 97mg/dl, at baseline and 12 months post-operative respectively [16]. Yang et al., also reported improvement in FPG compared to baseline throughout the 12-months follow-up period. FPG was seen to reduce from diabetic levels (180mg/dl) to 106mg/dl [17]. In our study, the mean baseline FPG is 161mg/dl, while the mean FPG at 12 months post-operative is 102mg/dl.

According to Kumar et al., the mean PPG was 208mg/dl, and 167mg/dl, at baseline and 12 months post-operatively [19]. In our study, the mean PPG declined from 232mg/dl at baseline to 149mg/dl at 12 months post-operatively.

HbA1c followed a similar pattern to that of both FPG and PPG. A significant reduction was observed from baseline (8.5) to 3 months (7.0) and continued to decrease throughout the follow-up period until stabilizing at the 12 months (5.9), as reported by Yang et al., [17]. Similarly, in our study, HbA1c, demonstrated a significant reduction from 9.1 at baseline, to 7.9 at 3 months and continued to decrease to 5.9 at 12 months post-operatively.

Conclusion:

LSG is an accepted procedure for control of obesity and obesity related co-morbidity like type 2 DM with adequate remission of the disease.

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دور عملية تكميم المعدة بالمنظار في علاج النوع الثاني من مرض السكري في المرضى المصابين بالسمنة المفرطة

أصبحت عملية تكميم المعدة بالمنظار واحدة من أكثر العمليات شيوعاً لعلاج السمنة المفرطة. على الرغم من الدور الإيجابي لعمليات تحويل المسار بالمنظار في علاج النوع الثاني من مرض السكري والسمنة المفرطة، فإن الأبحاث تتجه الآن لمعرفة دور عمليات تكميم المعدة في علاج النوع الثاني من المرض السكري.

الهدف من هذه الدراسة هو معرفة دور عمليات تكميم المعدة بالمنظار في علاج النوع الثاني من المرض السكري في المرضى المصابين بالسمنة المفرطة.

تم إجراء عملية تكميم المعدة بالمنظار لخمسين مريضاً في الفترة بين سبتمبر ٢٠١٤ ويونيو ٢٠١٦ في دراسة مستقبلية في قسم الجراحة جامعة عين شمس وتم رصد جميع المرضى من حيث فقدان الوزن ونتائج السكر الصائم، ونسبة السكر بالدم بعد ساعتين ونسبة السكر التراكمي وذلك من خلال متابعة المرضى بعد ثلاثة وستة أشهر من إجراء العملية وأيضاً بعد سنة.

كان هناك فرق كبير جداً بين مؤشر كتلة الجسم قبل العملية وبعد ١٢ شهر من إجراء العملية. وتم الشفاء من النوع الثاني من مرض السكري في ٧٠٪ من المرضى وتحسن نسبة السكر التراكمي في ١٠٪ من المرضى.

وبالتالي فإن عملية تكميم المعدة بالمنظار هي عمليات بسيطة وفعالة لتحقيق إنخفاض ملحوظ في الوزن بالإضافة إلى تحسن ملحوظ في علاج النوع الثاني من مرض السكري وبالتالي إنخفاض تكلفة علاج مرض السكري وتحسن مستوى المعيشة.