Glycemic control postlaparoscopic sleeve gastrectomy in elder population

Original Article

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ABSTRACT

Introduction: The prevalence of Diabetes mellitus (DM) in the older population rises with advancing age. Numerous recent studies run to prove that the effectiveness of laparoscopic sleeve gastrectomy (LSG) in type 2 DM (T2DM) treatment and to discover the mechanisms of diabetes remission and improvement in glucose homeostasis after LSG, yet its results are still unclear. The aim of study is the assessment of the effectiveness of LSG in glycemic control of T2DM.

Patients and Methods: An observational study including prospective and retrospective data analysis of glycemic control post LSG surgery for 60 elder patient greater than or equal to 60 year, with obesity greater than or equal to 35 kg/m^2 who suffer from T2DM and follow-up in Helwan University surgery clinic from February 2023 to June 2024.

Results: A total of 60 obese patients with a mean age of 64.8 years, males and females. The mean BMI was 42.6 kg/m^2. Significant Reduction in mean glycated hemoglobin, from 9.2±1.4 pre to 6±0.9 at 12 m postoperative. Insulin therapy reduced from 38 (63%) patientsto 14 (23.3%) patients. 35 (58.3%) patient have complete remission from T2DM. Significant reduction in mean total cholesterol 252.8±27 to 185.8±30 and mean triglycerides 156.4±15 to 136.8±34 and mean low-density lypoprotein 180±21 to 130±40 mg/dl.

Conclusion: The significant association between LSG and postoperative improvement or resolution of T2DM and dyslipidemia greater than or equal to 60 years, makes no doubt that the indication for LSG as a metabolic surgery is fully present even at an advanced age.

Key Words: Bariatric surgery, metabolic surgery, sleeve gastrectomy, type 2 diabetes mellitus.

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INTRODUCTION

The life expectancy of geriatric population in the late decades shows significant rise. Finland reported in 2008 a 24.3 years rise for 60-year-old female and 22.8 years rise for males. However, obesity may interfere with the quality and expectancy of life. A major morbidity associated with obesity is type 2 diabetes mellitus (T2DM)[1].

The prevalence of DM in older population rises with advancing age. The highly prevalent Peripheral neuropathy associated with diabetes in these age group increases the risk of accidents, fractures, and the consequent functional impairment. In addition to DM associated with dementia and depression[2,3].

In the past few years, attention has been paid to the optimization of glycemic control in elders. Healthcare providers usually focus on reaching optimal glycemic control when caring for elder patients with diabetes. However, the emerging data challenges the benefits of tight glycemic control in older adults[4].

The recent recommendation of the American Diabetes Association for adult greater than or equal to 65 years old is to individualize glycemic goals. For cognitively intact individual with expected long-life, the glycated hemoglobin (HbA1c) should be less than 7.5%. However, with more comorbidities, impaired cognitive function, and/or impaired physical function, HbA1c targets of less than 8.0% or less than 8.5% are recommended, avoiding symptomatic hyperglycemia leading to acute complications[5].

In the last decade, laparoscopic sleeve gastrectomy (LSG) has become nearly the most commonly used primary bariatric procedures for morbid obesity[6,7]. Numerous recent studies run to prove that the effect of LSG on T2DM treatment is as good as laparoscopic Roux-en-Y gastric bypass (LRYGB), the benchmark operation for diabetic patients, to discover the Potential mechanisms of diabetes remission and improvement in glucose homeostasis after LSG, yet its results are still unclear[8].

LSG surgery is associated with an increase in insulin sensitivity and ß cell function which could be related to

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decrease ghrelin levels postoperatively. Therefore, it is assumed that the final effect of procedures involving gastric transection decreases the serum ghrelin levels and improves insulin sensitivity[9].

PATIENTS AND METHODS:

An observational study including prospective and retrospective data analysis of glycemic control post laparoscopic sleeve gastrectomy surgery in elder obese patients.

A total of 60 elder patient 60 years or above, with obesity 35 kg/m^2 or above who suffer from T2DM, have good performance status, underwent laparoscopic sleeve gastrectomy without major postoperative complications especially gastric fistula or major bleeding and follow-up in Ain Shams University geriatrics clinic and Helwan University Surgery clinic from February 2023 to June 2024.

Preoperative glycemic control first-line medications were metformin or sulfonylurea single therapy. For the second line-therapy, most patients shifted to dual therapy with metformin together with sulfonylureas or DPP-4 inhibitors. Or to three, or even more medications, and/or insulin therapy. The definition of DM remission is based on the recent consensus of HbA1c less than 6.5% without diabetic medications[10].

Together with pharmacological T2DM therapy, Patient preoperative fasting blood glucose (FBG), postprandial blood glucose (PPG), HbA1c, and lipid profile was recorded as baseline data. Patient data was collected at 1, 3, 6, 9, and 12 months follow-up postoperatively as follows; During a regular patient visit to the outpatient clinic and from records patient's change in pharmacological therapy for T2DM was recorded at the first month, then HbA1c, FBG, and PPG was added to follow-up starting from third then 6- and 9-month interval, while during the 12 months, postoperatively lipid profile was added. All data was compared with preoperative baseline data and with each other's.

Data collection

The data was collected from patient's medical records, including initial clinic notes, laboratory and operative reports, clinical progress notes, and during outpatient's clinic follow-up. Patients with missing data were excluded from the analysis.

Endpoint

Postoperative Glycemic control and control of dyslipidemia

Statistical analysis

Categorical variables were described by number and percent (N, %), while continuous variables were described by mean, standard deviation, and range (μ, SD, Range). For Paired data testing we use a paired t test for normally distributed data and Wilcoxon paired samples test for non-normally distributed data, while for more than two Repeated measures testing, we use Repeated measure ANOVA for normal distribution data, Friedman test for non-normal data, and Cochran's Q test for binary nominal data. For Simple linear correlation of normally distributed data, we use Pearson correlation and for non-normal data we use spearman correlation. Two tailed *P value* below 0.05 is considered statistically significant and very low *P value* was reported as *P* less than 0.001. All analyses were performed with the Statistical Package for Social Sciences (SPSS) version 23.0 (SPSS Inc., Chicago, IL, USA).

RESULTS:

A total of 60 elder obese patients with a mean age of 64.8 years, including 20 (33.3%) males and 40 (66.7%) females. Mean BMI was 42.6 kg/m^2 ranging from 36.8 to 50.9 kg/m^2. (Table 1).

The reduction in mean HbA1c was highly significant between different measures (*P<0.001*). This significance was noticed from the early 3-month measure (*P=0.001*) and then the following 6 month measure (*P<0.001*), the difference between HbA1c appear insignificant later with the 9 month and the follow-up 12 month measurements (*P=0.7*) (Fig. 1). Both FBG and PPG also show significant reduction in their means during the postoperative period (Table 2).

Number of patients controlled on insulin therapy dropped significantly during regular outpatient clinic glycemic adjustment visits, however, they were estimated in postoperative follow-up visits 1, 3, 6, 9, and 12 months (*P<0.001*). The drop in patient number continues till 9-month follow-up, however, it was statistically significant in the first month estimation (*P<0.001*) dropping from 63% representing 38 patients preoperatively to 40% representing 24 patient postoperatively. (Table 3) and (Fig. 2).

The remission rate of T2DM after 1 year of surgery reach 58.3%, while 15% (nine) patients their glycemic control improve in the form of a reduction in therapy and improve in HbA1c. (Table 4). The reduction in HbA1c was not correlated to the 1-year Excess weight loss (r=-0.09) (Fig. 3). There is highly significant reduction in patient's lipid profile after 1 year of surgery (*P<0.001*) (Table 5).

Table 1: Patients characteristics (n=60).

Patient characteristics	
Age (year), mean (range)	64.8±4.1 (60–74)
Sex(M/F) no (%)	20 / 40 (33.3/66.7)
BMI (kg/m²) mean (range)	42.6±2.4 (36.8–50.9)
NAFLD no (٪)	40 (66.7)
Dyslipidemia no (٪)	37 (61.7)
HTN no (٪)	16 (26.7)
Smoking no (%)	17 (28.3)

BMI, Body Mass Index; HTN, hypertension; NAFLD, nonalcoholic fatty liver disease.

Table 2: Blood glucose measurements (n=60)

		Post-operative µ±SD (range)				
	Pre-operative µ±SD (r)	3 m	6 m	9 m	12 m	*P* value
Hb A1c (%)	9.2±1.4 (6.6–11.9)	7.9±1.6 (5.4–8.11)	6.8±1.9 (5.2–11.5)	6.7±2 (4.9–12.3)	6±0.9 (4.8–8.1)	< 0.001
FBG (mg/dl)	161.7±16.3 (131–194)	127.9±14.8 (89–154)	116.6±18 (76–159)	109.2±19.5 (68–155)	101.6±25.3 (65–155)	< 0.001
PPG (mg/dl)	232.2±19.2 (202–268)	177.3±23.2 (132–241)	166.7±22.9 (132–233)	153.8±26 (112–265)	148.4±31.5 (103–277)	< 0.001

µ, mean; FBG, fasting blood glucose; PPG, postprandial blood glucose; r, range; SD, standard deviation.

Table 3: Type 2 diabetes mellitus Treatment (n=60).

		Postoperative no (%)					
	Pre-operative no (%)	1 m	3 m	6 m	9 m	12 m	*P* value
Insulin therapy	38 63	24 40	20 33.3	18 30	14 23.3	14 23.3	< 0.001
Oral medication	60 100	48 80	39 65	32 53.3	26 43.3	25 41.7	< 0.001
Stop treatment	–	12 20	21 35	28 46.7	34 56.7	3558.3	NA

NA, not applicable; no, patient number.

Table 4: Type 2 diabetes mellitus outcome after 1 year of surgery (n=60).

T2DM postsleeve	
No Improvement no (٪)	16 (26.7)
Improvement no (٪)	9 (15)
Remission no (٪)	35 (58.3)

Table 5: Lipid profile of patients (n=60)

Lipid	Preoperative µ±SD (range)	12 months postoperative µ±SD (range)	*P* value
Total cholesterol (mg/dl)	252.8±27 (195–312)	185.8±30 (151–232)	< 0.001
Triglyceride (mg/dl)	156.4±15 (126–181)	136.8±34 (90–194)	< 0.001
HDL (mg/dl)	40.5±3.9 (30–47)	41±2.9 (30–47)	0.28
LDL (mg/dl)	180±21 (132–235)	130±40 (80–189)	< 0.001

HDL, high-density lipoprotein; LDL, low-density lipoprotein.

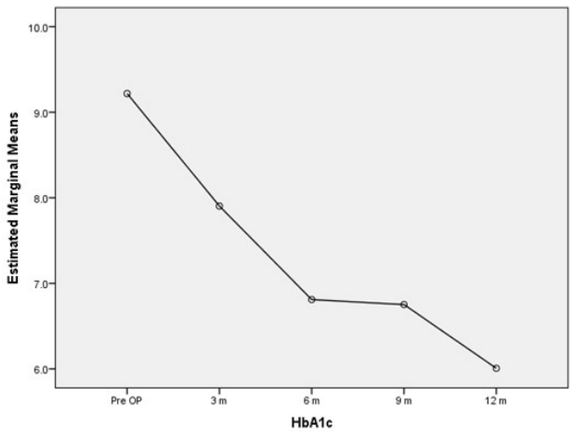

Fig. 1: Means of repeated HbA1c measures, preoperative then 3, 6, 9 and 12 months postoperative.

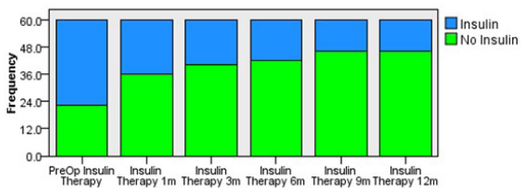

Fig. 2: Chart for pre and postoperative patients on insulin therapy

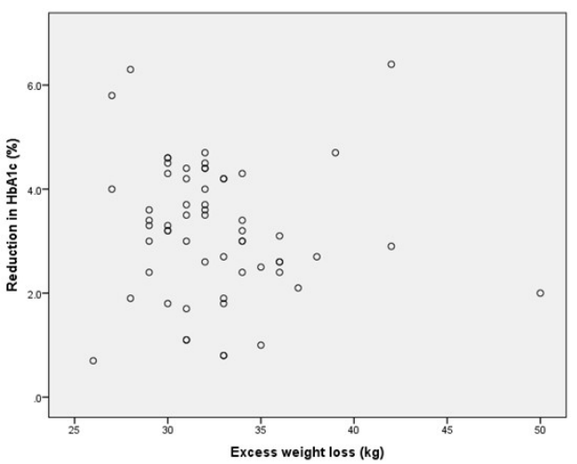

Fig. 3: Scatter plots show no correlation between EWL and Change in HbA1c at 12 months postoperative.

DISCUSSION

Many factors contribute in the prosperity of bariatric surgery in general, those factors specifically enable the adoption of bariatric surgeries in elder obese population[11]. The modern laparoscopy made bariatric surgery less invasive[12]. The rapidly established surgical technique, and the multidisciplinary perioperative management progression enables enhanced recovery from surgery[13]. LSG, with its short learning curve, high efficacy, and relatively low mortality and morbidity, is considered the ideal choice by many bariatric surgeons in elderly high-risk population.

Our study showed a significant reduction in HbA1c which was noticed in 3 months, and 6 months follow-up. Similar results in the adult population reported by Pullman *et al*.[14] showing reduction in HbA1c below 6% in 26 of 54 (48%) at 1 year post LSG. Also in a study by Yang *et al*.[15], the researchers followed-up patients after LRYGB and LSG for 3 years, and reported drop in mean HbA1c in LSG patient from 8.5±1.2 to 5.9±0.7% postoperatively. 5 year follow-up for nonobese patients and class I obesity by Hsu *et al*.[16] found a significant mean reduction in HbA1c of 2.1% after LSG. Another study by Horwitz *et al*.[17] on class I obesity patient show same results. In adolescent population El-Matbouly *et al*.[18] reported significant reduction of mean HbA1c in from 6 to 5.1% postoperatively. While Asiri *et al*.[19] study showed also marked reduction in HbA1c among pediatric participants from 6.0±0.8 pre to 5.4±0.4 post-LSG.

As regards blood sugar measurements our study found that both FBG and PPG also show significant reduction in their means during the postoperative period. This approves with Moradi *et al*.[20] who's study showed complete remission of DM in 75.8% and partial remission in 5.6% of patients one year postoperative however he followed old remission detention of HbA1c less than 6% and FBG less than 100 mg/dl in the absence of antidiabetic medications. And define partial remission as HbA1c 6–6.4% and FBG 100–125 mg/dl in the absence of antidiabetic medications. Regarding PPG, Douros *et al*.[21] agrees with our results as they stated that reduction of hyperglycemia following surgery is superior to medical treatment and/or caloric restriction and that many patients with diabetes achieve remission after surgery.

Our study found that the number of patients controlled on insulin therapy dropped significantly during regular outpatient clinic glycaemic adjustment visits, however, they were estimated in postoperative follow-up visits 1, 3, 6, 9, and 12 months. Compatible finding in a study by Astiarraga *et al*. showed a significant improvement of insulin sensitivity in postoperative months. Also in Douros and colleagues study, postoperative fasting and insulin suppression of Hepatic glucose production (HGP) were lower than before surgery. This findings is reported clearly in several studies showing higher insulin sensitivity in subjects with or without DM receiving bariatric surgery than are weight-matched subjects without surgery[21].

We also found that the remission rate of T2DM after one year of surgery reached 58.3%, while 15% of patients their glycaemic control improved in the form of reduction in therapy and in HbA1c. Busetto *et al*. showed a direct correlation between weight loss and the remission of diabetes following various surgical procedures[22]. Purnell *et al*.[23] also found DM remission occurred in 57% (46% complete, 11% partial) after RYGB and 22.5% (16.9% complete, 5.6% partial) after laparoscopic gastric banding (LAGB).

Finally, our study stated a significant reduction in patient's lipid profile after 1 year of surgery. Published studies showed that bariatric surgery in general reduce the following metabolic parameters; HbA1c, total cholesterol, and triglycerides, while increasing the high-density lipoprotein-cholesterol. Those benefits were also identified among Brazilian older adults in a study conducted by Pajecki *et al*.[24] This also approves with Zaki *et al*.[25] who found a significant change in the mean level of triglycerides as it was significantly higher preoperatively compared with its mean level postoperatively. Furthermore, a significant change was observed in high-density lipoprotein.

So, the significant witnessed association between LSG and postoperative improvement or resolution of T2DM and dyslipidemia at or above the age of 60 years, makes no doubt that the indication for LSG as a metabolic surgery is fully present even at an advanced age.

Acknowledgments

Data Availability Statement: The data that support the findings of this study are available on request from the corresponding author.

CONFLICT OF INTEREST

There are no conflicts of interest.

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