ORIGINAL ARTICLE

CLINICAL OUTCOMES OF LAPAROSCOPIC SLEEVE GASTRECTOMY IN REMISSION OF TYPE II DIABETES: A RETROSPECTIVE ANALYSIS

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ABSTRACT

Introduction: In recent years, sleeve gastrectomy has emerged as a potential treatment option for obese patients with type 2 diabetes, as it has been shown to improve glycemic control and even induce remission of the disease in some cases. The aim of this study was to determine the clinical outcomes of laparoscopic sleeve gastrectomy in remission of type-II diabetes.

Material & Methods: This retrospective observational study was carried out at Shifa International Hospital, Islamabad, Pakistan and the records of patient data were analyzed from January 2012 to January 2019 who were treated for morbid obesity. We included adult patients (aged 18-70 years) with severe obesity (BMI >35 Kg/m2) diagnosed with type II diabetes (baseline HbA1C >6.5) who had completed 36 months of follow-up post-operatively at our center. We excluded patients with type 1 diabetes and those who presented for revision bariatric surgery. T2DM diagnosis was established according to American Diabetes Association criteria.

Results: In this study a total 55 patients were enrolled. After three years of surgery, complete remission of diabetes mellitus was observed in 22 (59.46%) patients, partial remission in 10 (27.03%) while 5 (13.51%) patients were reported to have some improvements out of the total improved group patients 37(67.27%).On 3 years follow up after surgery; the mean HbA1C, BMI and fasting blood glucose level was 5.98%,31.64kg/m2 and 98.23, respectively.

Conclusion: This study concluded that laparoscopic sleeve gastrectomy is an effective, safe and reliable surgical procedure in the management of obese patients with type II diabetes mellitus and is associated with promising results in the type II diabetes remission and improving the BMI and glycemic control in terms of HbA1C, and fasting blood sugar levels.

Key Words: Clinical Outcomes, Laparoscopic Sleeve Gastrectomy, Remission, Retrospective Analysis, Type-II Diabetes Mellitus

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INTRODUCTION

Globally, the obesity and diabetes twin epidemics pose a serious threat. Numerous epidemiological research show that diabetes and obesity are rising at the same time. The word "diabesity" describes how closely these two metabolic illnesses are related to one another, with both being marked by deficiencies in insulin activity.[1] Both diagnoses leads to adverse physical, mental, psychological, and financial outcomes for those affected.[2] An increasing amount of evidence has shown obesity to be a major risk factor for type 2 diabetes development. Indicating that individuals with the condition may experience better glycemic control after losing weight.[3] Due to its ability to enhance glycemic control and, in certain situations, even cause remission of the disease, sleeve gastrectomy has gained popularity as a possible therapeutic option for obese individuals with type 2 diabetes in recent years.[4-7]

Sleeve gastrectomy has been shown to result in an average excess weight loss of 72.4% three years after the surgery. [8] It also results in improved metabolic health parameters such as blood sugar control, cholesterol levels, and blood pressure.[9] Sleeve gastrectomy has a relatively low complication rate compared to other weight-loss surgeries. A 2023 comparative analysis published in the Annals of Surgery determining the safety comparison between sleeve gastrectomy and gastric bypass reported that Sleeve gastrectomy was linked to a reduced 5-year cumulative incidence of death as compared to gastric bypass (1.29% vs 2.15%), complications (11.5% vs 16.2%), hospitalization (43.7% vs 53.7%) and reoperation (18.5% vs 22.8%).[10]

Patients who undergo sleeve gastrectomy have reported improvements in symptoms of anxiety and depression along with their functional abilities and self-esteem.[11] Compared to other weight-loss surgeries, sleeve gastrectomy has a lower risk of nutritional deficiencies because it does not involve rerouting the intestines. A study published in the Journal of the Academy of Nutrition and Dietetics reported that patients who underwent sleeve gastrectomy had lower rates of nutrient deficiencies compared to those operated through gastric bypass.[12]

Our study's main objective was to investigate sleeve gastrectomy's outcomes in term of type 2 diabetes remission in the Pakistani population. The results extrapolated from this study can help clinicians better manage diabetes and offer bariatric surgery as an alternative to years of medical management, especially in populations experiencing a faster rate of complications such as diabetic nephropathy, neuropathy, and micro, and macrovascular side effects.

MATERIAL AND METHODS

This retrospective observational study was carried out at Shifa International Hospital, Islamabad, Pakistan. After the approval of IRB (approval number IRB 466_21) and consent from patients, records of patient data were analyzed from January 2012 to January 2019 who were treated for severe obesity through laparoscopic sleeve gastrectomy (LSG).

Data Selection:

We included adult patients (aged 18-70 years) with severe obesity (BMI >35 Kg/m2) who had a diagnosis of Type-2 diabetes according to American Diabetes Association criteria and had completed 36 months of follow-up post-operatively at our center. DM patients who were not taking any medications or insulin were not included in our study while those who presented for revision bariatric surgery or diagnosed with type 1 diabetes were excluded.

At baseline, all patients consulted with a bariatric surgeon, nutritionist, and endocrinologist. The recommendation of this multidisciplinary team was taken regarding the need for bariatric surgery. Demographics such as age, sex, height, baseline weight, BMI and fasting blood sugar levels were noted. We extracted years since diagnosis of DM and also pre-morbid condition like hypertension by extensive chart review. The definitions of the progression of T2D following bariatric surgery that are specified by the American Society of Bariatric and Metabolic Surgery were incorporated in the present study.

Operative technique:

The patients were appropriately draped and prepped for surgery and were placed in the French position under general anesthesia to facilitate access to the abdominal cavity. A total of four ports were placed to allow access for surgical instruments and visualization. The stomach was then identified and carefully mobilized. Attention was given to the greater curvature and omentum, ensuring adequate exposure. Dissection was carried out to separate the stomach from the greater curvature until reaching approximately 4cm proximal to the

pylorus. Calibration of the stomach was then performed using a bougie or calibration tube. A 40 French bougie was passed down the lesser curvature to help determine the gastric sleeve's size. A 60mm stapler was then introduced, starting from approximately 4cm proximal to the pylorus and extending towards the gastroesophageal (GE) junction. The stapler was fired to create the sleeve gastrectomy, effectively removing a portion of the stomach along the greater curvature. Upon completion of the sleeve gastrectomy, the ports used for surgical access were closed with staples or sutures as per standard practice.

The patients were divided into three groups:

1. The improved outcome group included patients with complete remission, partial remission, and improvement. When the patient's FBG was <100 mg/dL [< 5.5 mmol] and with HbA1C <6%, it was categorized as achieving complete remission. A partial remission was defined as HbA1C of 6%–6.4% and an FBG of 100–125 mg/dL (5.5–6.9 mmol/L) in the absence of antidiabetic treatment. Improvement in the absence of antidiabetic medication was demonstrated by a drop in the need for antidiabetic medication or a decrease in the HbA1C and FBG without reaching remission criteria.[13]
2. No change in outcome group included patients with absence of remission or improvement and with the same HbA1C as before the procedure.[13]
3. Worsened outcome group included patients with raised HbA1C after the procedure when compared to baseline

We set follow-up visits at three-time points; a one-month follow-up was set to understand the immediate glycemic outcomes post LSG. Three-year follow-up was set to understand the long-term glycemic outcomes and six months follow-up to see the changes in between. Change in weight, glycemic control, and medication usage was obtained from postoperative outpatient visits in the clinic or by telephone.

Statistical analysis

The statistical software SPSS 21 was used to analyze the data. The chi square test was used to compare categorical variables, which were reported as frequencies and percentages. Using Student's t-test, continuous variables were compared and shown as means and standard deviations. To determine whether the numerical variables were normally distributed, the Shapiro-Wilk test was employed. Mean and standard deviation were reported for the follow up values of BMI, fasting blood sugar and HBA1C.Two-tailed P values were reported, with P <.05 taken as statistically significant.

RESULTS

Demographic Characteristics

Fifty-five patients were included in the study. Male patients constituted 28 (51%) of the sample, compared to female patients 27 (49%).Mean age of the participants was 38 years. Mean BMI recorded at baseline was 45.14 while baseline mean weight in Kg was 142. The mean duration of diabetes was 7 years, while the mean HBA1C prior to surgery was 8.85. (Table 1)

Clinical Outcomes in terms of remission of diabetes

After three years of surgery improved outcomes were evident in 37 (67.27%) patients, worsened outcome in 5 (9.09%) patients, and no change was noted in 13 (23.64%) patients. Complete remission of diabetes mellitus was observed in 22 (59.46%) patients, partial remission in 10 (27.03%) while 5 (13.51%) patients were reported to have some improvements. (Table 2)

Clinical Outcomes in terms of improvement in BMI

BMI of the participants showed improvement when assessed throughout the follow up intervals. As the pre-operative bassline BMI recorded was 45.14, the participants demonstrated a significant decrease when assessed in follow up period i.e. 42.76 in 1st month post operatively, 36.83 six months post operatively and 31.64 after 3 years. (Table 3)

Clinical Outcomes in terms of improvement in HBA1C

The patients' mean HbA1C was 8.37 during the first month of follow-up following surgery, and it was reported at 7.52 during the sixth month of follow-up as well. Following surgery, the patients' mean HbA1C improved to 5.98 at the 3-year follow-up. (Table 4)

Clinical Outcomes in terms of improvement in fasting blood sugar

On pre-op evaluation of the patients, the mean FBS of the patients was 219. At the one-month follow-up following surgery, the patients' mean FBS was recorded at 207. When evaluated three years following surgery, the patients' mean FBS improved dramatically (mean 98.23) compared to the sixth month follow-up, when the patients' mean FBS was 172.56.(Table 5).

DISCUSSION

In recent years, studies have illustrated that

owing to the advances in medical science and surgical procedures, the type II diabetes can be treated with performing bariatric surgeries. Evidence has shown that, in patients undergoing sleeve gastrectomy, the insulin resistance improves, and even diabetes mellitus remission can occur without the need for oral hypoglycemic medication.[14,15]

Based on the limited number of prospective, randomized, and retrospective trials, a meta-analysis established that LSG exhibits a similar impact on T2D as RYGB.[16,17] There is disagreement in the literature on T2D remission following LSG. In the short term, many studies have indicated a resolution rate for diabetes of 60% to 90% following LSG, [18,19] while in contrast some studies have found minimal efficacy of LSG in the remission of type II diabetes mellitius.[20,21] It is unclear if the significantly different rates of remission observed in the LSG investigations are due to the lack of a defined definition of T2D resolution or to the ethnicity of the patients. Another explanation could be that the definitions of "improvement," "resolution," "remission," or "cure" of diabetes utilized in these trials were different.[22]

Following bariatric surgery, glycemic control can be improved by a variety of routes, including hormonal changes, histological changes, cellular changes, and microbiome modifications. The larger improvement in glucose levels after GBP compared to diet or gastric banding may be mediated by the shift in gut hormone incretins following GBP and their subsequent impact on insulin or glucagon release.[23] Increased peak and total postprandial GLP-1 production was observed following surgery in multiple trials, compared to pre-operative values.[24,25,26] Some theories regarding the reduction of ghrelin levels post operatively after bariatric surgery suggests the reduction of further weight loss and improvement in glycemic control but no such high quality evidence exists in supporting the theory and further research is warranted.[27]

The results of our study showed that, following three years of surgery, 37 patients (67.27%) had improved outcomes, 5 patients (9.09%) had poor outcomes, while 13 patients (23.64%) had no change at all. These are consistent with the work done by Todkar et al and colleagues, the findings of which demonstrated the resolution rate of 72% after three years while in contrast resolution rate of 24% was reported by Schauer et al after Laparoscopic Sleeve Gastrectomy.[19,20] Our study illustrated that complete remission of diabetes mellitus was observed in 22 (59.46%) patients, partial remission in 10 (27.03%) while 5 (13.51%) patients were reported to have some improvements The differences with previous results could be explained by a different demographic and a stricter definition of remission criteria.

A systematic review and meta-analysis conducted to determine the remission rate of type II diabetes mellitus after bariatric surgery depicted that 2018 SG patients and 9926 RYGB patients were compared at a 1-year follow-up period. This meta-analysis showed that T2DM remission occurred substantially less frequently following SG compared to RYGB when results were analyzed independently of the criterion of T2DM remission used; 56.29% of patients experienced remission following SG, compared to 60.91% after RYGB.[28] While the remission rate in our study was 67.27% and is consistent with the findings of the systematic review, however the follow up was performed and glycemic control was measured after 3 years of follow up as opposed to 1 year.

In terms of blood glucose levels, our patients showed a significant improvement in glycemic metabolism. On 3 years follow up after surgery; the mean FBS of the patients was 98.23 mg/dl compared with pre-operative values of 219 mg/dl demonstrating a statistically significant difference (p-value=<0.001) in fasting glucose level before and after surgery. These results are also in accordance with another study, the results of which demonstrated that after 12 months without taking oral metformin or insulin, individuals with a mean drop in HbA1c of 3.1 mg/dl had a significant improvement in their glycemic metabolism and DM remission.[29]

The ABCD score is a useful tool in clinical practice when selecting the surgical technique of choice for the treatment of type 2 diabetes. Even though the initial scoring system was created for patients undergoing gastric bypass surgery, however it can also be used for individuals undergoing LSG.[30] The author would advise to use LSG for T2 DM in patients who have ABCD score greater than 4 as greater scores on ABCD score as associated with higher remission rates of diabetes mellitus.

Our study has certain limitations because it was limited to one center, which may have affected

how broadly our findings can be applied to a broader population. Furthermore, the one-year research period and the three-year follow-up may not have been sufficient to capture long-term results; a longer observational period could offer a more thorough understanding of the long-term effects of laparoscopic sleeve gastrectomy on diabetes remission. Moreover, it was difficult to completely control for other confounding factors like differences in patient compliance with postoperative treatment or lifestyle modifications. Future research should collaborate across several centers, extend follow-up periods, and carefully examine other factors that impact postoperative outcomes in order to overcome these constraints.

CONCLUSION

This study concluded that laparoscopic sleeve gastrectomy is an effective, safe and reliable surgical procedure in the management of obese patients with type II diabetes mellitus and is associated with promising results in the type II diabetes remission and improving the BMI and glycemic control in terms of Hba1c and fasting blood sugar levels. However pre-operative BMI, and significantly elevated preoperative glycated hemoglobin levels could be predictive variables for the inability to achieve a full remission of type 2 diabetes following laparoscopic sleeve gastrectomy.

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Table 1: Demographic and pre-operative characteristics of the sample

Variables	Frequency (Percentages)
Gender	Male 28(51%)
	Female 27(49%)
Age (years)	38
Pre-operative Weight (kg)	142 kg
BMI (kg/m2)	45.14
Duration of diabetes(years)	7
Pre-operative HBA1C	8.85
Pre-operative fasting blood sugar (mg/dL)	219 (mg/dL)
Mean Hospital stay	3 days
Hypertension	37(68%)

Table 2: Clinical Outcomes in terms of remission of diabetes

Outcomes	Frequency/percentages
Improved Outcomes	Complete remission: 22 (59.46%)
	Partial remission: 10 (27.03%)
	Improvement: 5 (13.51%)
No change in outcome	13 (23.64%)
Worsened outcome	5 (9.09%)

Table 3: Comparison of BMI between outcomes at different follow-up intervals

Pre-Operative BMI (Mean)	BMI assessed at different time intervals	Post-operative BMI (Mean)
45.14 (kg/m2)	1st Month	42.76
	6th Month	36.83
	3rd Year	31.64

Table 4: Comparison of HbA1c between outcomes from pre-op to 3rd year after surgery

Pre-Operative HbA1c (%) (Mean)	HbA1c assessed at different time intervals	Post-operative HbA1c (%) (Mean)
8.85	1st Month	8.37
	6th Month	7.52
	3rd Year	5.98

Table 5: Fasting blood sugar level between outcomes from pre-op to 3rd year after surgery

Pre-Operative Fasting Blood Sugar (mg/dL) (Mean)	Fasting Blood Sugar assessed at different time intervals	Post-operative Fasting Blood Sugar (mg/dL) (Mean)
219 (mg/dL)	1st Month	207.13
	6th Month	172.56
	3rd Year	98.23