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The Effect of Laparoscopic Sleeve Gastrectomy on Diabetes Mellitus Type 2

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Abstract: Laparoscopic sleeve gastrectomy is a very common operation done on obese patients who hope to reduce their weight and cure metabolic syndrome illnesses such as diabetes mellitus type 2 and dyslipidemia. This technique is being widely used for treatment of diabetes. The effectiveness of laparoscopic sleeve gastrectomy in curing diabetes mellitus was studied on Arab population. We assessed 400 obese patients who underwent laprascopic sleeve gastrectomy from 2011 to 2017 in King Fahd General Hospital in Jeddah, KSA. Out of the 400 patients 93 had diabetes mellitus type 2, which were included in this study. All patients showed an improvement in their body weight, body mass index and fasting blood glucose, however a few patients still showed elevated blood glucose levels after their operations. Based on our results we can conclude that laparascopic sleeve gastrectomy was effective in improving the conditions associated with diabetes mellitus type 2 among local population.

Keywords: Diabetes mellitus type 2, body weight, BMI, fasting blood glucose, laproscopic sleeve gastrectomy.

INTRODUCTION

A strong correlation has been established between obesity and diabetes, obese individuals having an increased risk of developing type 2 diabetes mellitus (T2DM). It is known that 90% of patients suffering from diabetes are over-weighted [1].

Obesity has been classified on the basis of body mass index (BMI). Surgical intervention is the most effective method for treating morbid obesity which is followed on the basis of BMI. NIH in 1991 and International Federation of Diabetes in 2011 has given recommendations for surgery being a suitable intervention in people having a BMI $\geq$35 kg/m^2 plus an obesity-related disease such as T2DM, obesity induced cardiomyopathy, etc [2,3]. Though the conventional treatment for diabetes includes life style modifications and pharmacotherapy, it is difficult to achieve ameliorative results with this approach in diabetic patients that are obese [4]. Hence there has been growing focus and awareness about bariatric and metabolic surgery for alleviating the conditions associated with diabetes over past two decades [5].

There has been a rise in the use of bariatric surgical intervention, mostly laparoscopic sleeve gasterectomy (LSG) for treating diabetes since it is a minimally invasive and highly effective procedure [6]. Moreover, it has been observed that in non-severely obese diabetic patients LSG is even more effective than pharmacotherapy and also results in the improvement of diabetes-associated metabolic conditions [7]. Patients who have undergone LSG have been observed to undergo a reduction in consumption of anti-diabetic, anti-hypertensive and lipid-lowering medications apart from a noticeable weight and abdominal fat loss [8].

Despite all the control measures, diabetes remains a highly prevalent disease among different age-groups of both men and women in developed as well as developing countries. Saudi Arabia itself ranks second in the Middle-East and seventh in the world for prevalence of diabetes [9]. A significant amount of research has been conducted on the topic of diabetes emphasizing on laparoscopic surgery. However, seeing that the prevalence of T2DM in Kingdom of Saudi Arabia which is 31.6% [10], we believe the topic of this research is of utmost importance since it focuses on the outcome of LSG in local population.

MATERIALS AND METHODS

This study was approved by the Institutional Review Board of King Fahd Hospital which follows the ethical standards of Helsinki declaration. After reviewing 400 filed records of patients registered in King Fahd Hospital between the year 2011 and 2017, only 93 patients passed the inclusion criteria and were enrolled in the study.

Inclusion criteria

Obese diabetic patients who had a laparoscopic sleeve gastrectomy operation between the year 2011-2017 with fasting blood glucose (FBG) exceeding 125 mg/dL, BMI ≥ 30 and atleast 3 months of post-surgical follow up.

Exclusion criteria

All patients who had a preoperative FBG lower than 125 mg/dL and BMI less than 30 and those who had undergone a bariatric surgery other than LSG were excluded from the study. The patients were followed up to see if the surgery had an impact on reducing their fasting blood glucose levels and also to check if they were cured from the disease. The data on body weight, FBG and BMI both pre and post operation was carefully tabulated and segregated according to gender as well as age groups and statistical analysis was done.

DATA ANALYSIS

Statistical analysis was performed using SPSS software package. To check the statistical differences in data, paired sample T-test was used and $p < 0.05$ was considered as significant for all statistical analyses in this study.

RESULTS

A total of 93 patients were observed of which 30 were male and 63 were female. The distribution of males and females according to various age groups is summarized in Table 1.

Table-1: Age groups by gender

Gender	Age group 21-30	Age group 31-40	Age group 41-50	Age group 51-60	Age group >60
	%	%	%	%	%
Female	15.9%	39.7%	22.2%	17.5%	4.8%
Male	16.7%	43.3%	26.7%	13.3%	0.0%

Data is expressed as mean ± SE * means $p \leq 0.05$

Changes in body weight, BMI and fasting blood glucose pre and post operation were tabulated based on gender as well as age-groups. On an average among all 93 patients, weight after the operation decreased from 121.34 kg to 92.23 kg, the average weight loss being 29.1 kg. Table 2 shows the difference in weight classified according to gender before and after operation.

Table-2: Change in weight pre and post operation based on gender

Gender	Pre operation weight	Post operation weight	Difference in weight after operation
	Mean	Mean	Mean
Female	118	92	25.79 *
Male	128	92	36.10 *

Data is expressed as mean ± SE * means $p \leq 0.05$

The age groups 21 - 30 and 41 - 50 years were the ones having highest pre operation weight with an average of 126 kg, and the same age groups lost most of the weight post operation. The average loss in weight for both groups after the operation was 32 kg, while the age group more than 60 years was the one that lost least weight after operation, the average loss being only 16 kg (Table 3).

Table-3: Weight of patients before and after operation based on age group

Age group (years)	Pre operation weight	Post operation weight	Difference in weight after operation
	Mean	Mean	Mean
21-30	126	94	32.33 *
31-40	120	91	28.74 *
41-50	126	94	32.09 *
51-60	114	89	25.13 *
> 60	114	98	16.00 *

Data is expressed as mean ± SE * means $p \leq 0.05$

Table 4 and 5 summarize the change in BMI of patients pre and post operation classified according to gender and age group respectively. Analysis by age group shows that the average BMI before operation was highest in the age group from 41 to 50 years which decreased to 36 after the operation.

Table-4: BMI of patients before and after operation based on gender

Gender	Pre operation BMI	Post operation BMI	Difference in BMI after operation
	Mean	Mean	Mean
Female	46	36	10.05 *
Male	45	32	12.59 *

Data is expressed as mean ± SE * means $p \leq 0.05$

Table-5: BMI of patients before and after operation based on age group

Age groups (years)	Pre operation BMI	Post operation BMI	Difference in BMI after operation
	Mean	Mean	Mean
21-30	47	35	11.77 *
31-40	46	35	10.77 *
41-50	48	36	11.97 *
51-60	43	33	9.50 *
>60	45	38	6.28 *

Data is expressed as mean ± SE * means $p \leq 0.05$

Classified according to age groups, the fasting blood glucose pre operation was observed to be highest among age group 51-60 and beyond 60 years and at the same time, age group 51-60 showed the highest reduction in FBG (Table 6 and 7). Even though there was a marked improvement in FBG after operation, a few patients still showed its elevated levels (i.e, above 126).

Table-6: Fasting Blood Glucose (FBG) of patients before and after operation based on gender

Gender		Pre operation FBG	Post operation FBG	Difference in FBG after operation
		Mean	Mean	Mean
	Female	178	111	67.01 *
	Male	169	96	72.67 *

Data is expressed as mean ± SE * means $p \leq 0.05$

Table -7: FBG of patients before and after operation based on age group

Age groups (years)	Pre operation FBG	Post operation FBG	Difference in FBG after operation
	Mean	Mean	Mean
21-30	180	110	70.07 *
31-40	172	101	70.69 *
41-50	158	103	54.51 *
51-60	199	113	85.81*
>60	198	139	59.33 *

Data is expressed as mean ± SE * means $p \leq 0.05$

DISCUSSION

Despite lifestyle modifications and pharmacotherapy, diabetes continues to be a life-threatening disorder that is on a rise globally [11]. Obesity and diabetes are found to be linked very closely since obese individuals show an increased risk of acquiring type-II diabetes mellitus and majority of people having T2DM are known to be overweight [12]. Thus focus has been shifting to find alternate sources of treatment for diabetes. Laparoscopic sleeve gastrectomy is one of them which have been gaining tremendous significance since recent years especially among diabetic patients with severe obesity [13]. Our research focused on observing the effects of LSG on the Arab population where diabetes remains a highly prevalent metabolic disorder among all the age groups leading to severe complications.

It was observed that the body weight of patients declined significantly after LSG in both males and females. The greatest effect on body weight reduction after LSG was observed among age groups 21 - 30 and 41 – 50 and the least on age group > 60. A number of other studies show successful effect of laparoscopic surgery on weight loss in diabetic as well as non-diabetic populations [14, 15]. A significant reduction in BMI as well as on FBG of diabetic patients on our study population was seen both in males and females. It was observed that among females, the average fasting blood glucose was higher than that in males both pre and post operation. The effect of LSG on FBG was most predominant among the age group 51-60. Similar to our findings, many studies have shown effective glycemic control, lower blood glucose and normal BMI after performance of sleeve gastrectomy on diabetic patients [16, 17].

In our study, we also found that in Arab population, diabetes was most prevalent among age group 51-60 based on FBG levels which is confirmed

by global statistics as well, this age group being the highest of the affected ones [18]. LSG proved to be most effective in reduction of body weight, FBG and BMI among this age group of males as well as female patients.

Thus our study showed that LSG can be used as an effective treatment option for control of diabetic complications in all age groups. However, this study was limited to the measurements of body weight, FBG and BMI over a period of 6 years post operation. In order to further strengthen the use of LSG in control of diabetic complications, an in depth research based on measuring HbA1c and other diabetic parameters needs to be carried out over a larger period of time.

CONCLUSION

In conclusion, LSG was effective in lowering the body weight, BMI and FBG of diabetic patients and thus could be used in control of type 2 diabetes mellitus in Arab population, among both males as well as females.

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