Metabolic Improvement in Blood Glucose and Cholesterol after Sleeve Gastroectomy

Abdu Hasan Al-zobaydi¹*, Samer Alkarak¹, Omar Ibraheem Sharif² and Ali Mothanna Alzubaid³

¹Department of Laparoscopic and Bariatric Surgery, King Khalid Hospital, Najran, Saudi Arabia
²Department of Gastroenterology and Hepatology, King Hamad University Hospital, Bahrain
³Department of Gastroenterology, King Khalid Hospital, Najran, Saudi Arabia

*Corresponding Author: Dr. Abdu Hasan Alzobydi, Consultant Laparoscopic and Bariatric Surgeon, Department of Laparoscopic and Bariatric Surgery, King Khalid Hospital, Najran, Saudi Arabia, Tel: +966 17 522 4116; E-mail: alzobydi@yahoo.com

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Abstract

**Objective:** To investigate the long-term effects of laparoscopic sleeve gastrectomy on weight loss, blood sugar and cholesterol.

**Materials & Methods:** A total of 306 morbidly obese patients who underwent laparoscopic sleeve gastrectomy over three years from 2014-02-2017 at King Khalid Hospital Obesity Center, Najran (Saudi Arabia ) monitored postoperatively for a periodically over 24 months duration for weight reduction and metabolic changes by measurement of BMI, total body cholesterol and fasting blood sugar lower than 126 mg/(5.6-7 mmol). Hypercholesterolemia was defined as a total cholesterol level higher than 240 mg/dl (6.2 mmol), total cholesterol 200-240 mg/dl (5.2-6.2 mmol) considered as borderline, and less than 200 mg/dl (5.2 mmol) is normal.

**Result:** The percentage of excess body weight was 50.8% (68 kg) and the percentage of excess weight loss was 18%, 34%, 55.6% and 73% at 3, 6, 12 and 24 months respectively and this excess weight loss was significant with P-value less than 0.00001 and T value of 9.08. Blood sugar was significantly improved from preoperative 6 mmol to postoperative 5.75, 5.3, 5 and 4.3 mmol at 3, 6, 12 and 24 month respectively and this improvement was statistically significant as calculated using both T calculator for two dependent mean and the f-ratio value both yield P-value is <0.00001 which is statistically significant at p<0.01 and continue follow up for the mean blood sugar was normalized (4.3 mmol) which also statistically significant. Total body cholesterol was decreased from mean preoperative 5.6 mmol to 5.24, 5.2, 2, 4.97 and 4.3 mmol in 3, 6, 12, 24 months respectively and this reduction was statistically significant at P-value less than 0.01.

**Conclusion:** Sleeve gastrectomy is a safe and effective bariatric procedure with approximately 75% of the excess weight loss achieved at the first two-years, normalized blood sugar occurs in 96% of patients with normalization of total body cholesterol in all with satisfactory long-term results regarding weight loss and co-morbidities.

Keywords: Morbid obesity; Metabolic syndrome; Sleeve gastroectomy

Introduction

Obesity is a major risk factor for mortality and morbidity from cardiovascular diseases, metabolic disease, cancers, and musculoskeletal disorders, causing nearly 3 million annual deaths worldwide [1,2], the epidemic of obesity in the recent years is one of the major health problems which influence many aspects of public health, social, psychological and economic. At the year 2011 the WHO reported that approximately 10% of the world population has body mass index BMI >30. It has been observed during last 30 years that the percentage of people with morbid obesity almost doubled [3]. Since the year of 1980 there is an increase in mean BMI. The mean population BMI in 2008, varied substantially across nations. Measures and policies that can prevent or reverse the increase in BMI and mitigate its effects in health of populations by targeting its metabolic mediators are needed in most countries [4,6]

Multi-center studies have shown that adiposity, as measured by body mass index (BMI, calculated as weight in kg over height in meter, has increased in recent decades in many populations [7,8] although BMI seems to have been stable or even decreased in some groups [9-12].

Body mass index of both above and below the apparent optimum of about 22.5-25 kg/m² is in itself a strong predictor of overall mortality [13].

Bariatric surgery is a valuable way for fighting against obesity and its sequel. Excess weight loss, will result in resolution of diabetes, improve lipid profile, sleep apnoea and cardiac remodelling with a significant reduction in cardiac risk profile, all those provide compelling arguments for an expansion of metabolic surgery.

The collaboration between multidisciplinary teams (surgical, Endocrine, internist and laboratory) provides new light on the pathogenesis of metabolic syndrome and diabetes, through the
effectiveness of bariatric surgery, and heralds in a new era spurred for
the prevention of the epidemic [14].

Analysis study compared gut hormones after gastric bypass and
sleeve gastrectomy found that both exerted influence on glucagon-like
peptide 1(GLP-1), glucose-dependent insulin tropic peptide GIP,
obestatin and leptin, and bypass had an additional duodenal effect on
cholecystokinin [15]. After gastric bypass, the exaggerated GLP has
been associated with increased pancreatic beta cell function although
causal relation remains uncertain [16].

There are two phases of insulin secretion; the first phase is restored
considerably following sleeve gastrectomy. Basso in his study, reported
a "gastric hypothesis" for this restoration of 1st phase insulin secretion,
which improves glycemic control. They proposed that decrease in
vagally innervated, antral mucosa secretion of gastrin-releasing
peptide (GRP) in turn stimulated GLP-1 release [17].

The expansion from bariatric into metabolic surgery for sleeve
gastrectomy reflects the recognition of its fundamental role in the
correction of obesity related co-morbidities, particularly insulin
resistance diabetes. This consolidates evidence for the metabolic role
of bariatric surgery is that; its inclusion in the algorithm of the
International Diabetic Federation for type II diabetes [18].

Materials and Methods

A total of 306 morbidly obese patients who underwent laparoscopic
sleeve gastrectomy over three years from 2014-02-2017 at King Khalid
Hospital Obesity Center, Najran (Saudi Arabia) monitored
postoperatively for a periodically over 24 months duration for weight
reduction and metabolic changes by measurement of BMI, total body
cholesterol and fasting blood sugar.

Diabetes Mellitus was defined as a fasting blood glucose cut point
of ≥126 mg/dl (7.0 mmol/L) or any levels in a patient receiving
antihyperglycemic medications.

Impaired fasting glucose (IFG) was defined as a fasting glucose level
higher than 100 mg/dl and lower than 126 mg/(5.6-7 mmol). Hypercholesterolemia was defined as a total cholesterol level higher than 240 mg/dl (6.2 mmol), total cholesterol 200-240 mg/dl (5.2-6.2
mmol) considered as borderline, and less than 200 mg/dl (5.2 mmol) is
normal.

Remissions DM and IFG were defined as a normal fasting glucose
level (less than 7 mmol) for DM and less than 5.6 mmol for IFG
respectively, off of insulin or oral medications.

Partial remission of DM was defined as a reduction of medication
dosage or complete cessation of medication use despite the presence of
abnormal laboratory results. No partial remission was defined for IFG.
Remission of hyperlipidaemia was defined as normalization of total
body cholesterol off medications. Partial lipid remission was defined as
a reduction of medication dosage or cessation of medication use
despite abnormal laboratory results.

Our patient Demographics was 194 male (63%) and 112 female
(37%) with mean age 30.5 (14-60 years) and mean body mass index
49.6 (34.1 to 84.8). During the follow-up period for 24 week post sleeve
and all monitoring regarding improving in glycemic control, total
cholesterol and its correlation with decrease in BMI.

All the surgery done by the same surgeon, and follow up with the
same clinic and all patient screen preoperative for blood sugar and
total cholesterol and monitored thoroughly postoperative 3, 6, 12 and
24 months.

All LSG were performed by the same bariatric surgeon with the
same surgical team, Bougies of 32 Fr to 36 Fr was used to create the
gastric lumen and the stomach resection, started 2 to 4 cm from the
pylorus. Sleeve volume ranged (24-847.8) average 195.78. We used the
methylene blue dye leak test that was used to ensure an intact staple
line.

The percentage excessive weight loss (% EWL) was calculated by
assuming normal weight by body mass index (BMI; calculated as
weight in kilograms divided by height in meters squared) of 24 and
determined by divide the amount of post-operative excess weight loss
by the preoperative weight excess as measured by BMI and multiplying
the result by 100 [Preoperative BMI - Postoperative BMI] × 100.
Preoperative weight excess (BMI-24).

Statistical analysis

The statistical analysis was performed using social scientific
statistics website. The paired t-test was used to assess changes in
clinical measures for patients at different times. Statistical significance
was reached at P<0.01.

Result

A total of 306 LSGs were performed. Complete data were available
for all patients at the 24-months follow-up regarding excess weight
loss, fasting blood sugar, serum cholesterol and BMI. The percentage of
excess body weight was 50.8%, (68 kg) and the percentage of excess
weight loss was 18%, 34%, 55.6% and 73% at 3,6,12 and 24 months
respectively. And this excess weight loss was significant with P value
less than 0.00001 and T value of 9.08

Blood sugar was significantly improved from preoperative 6 mmol
to postoperative 5.75, 5.3, 5, and 4.3 mmol at 3, 6, 12 and 24 month
respectively and this improvement was statistically significant as
calculated using both T calculator for two dependent mean and the
f-ratio value both yield P-value is <0.00001 which is statistically
significant at p<0.01 and continue follow up for the mean blood sugar
was normalized (4.3 mmol) which also statistically significant as
shown in Table 1.

<table>
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<th>Characteristics</th>
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Table 1: Metabolic Effects of Laparoscopic Sleeve Gastrectomy.

Total body cholesterol was decreased from mean preoperative 5.6 mmol to 5.24, 5.22, 4.97 and 4.3 mmol in 3, 6, 12, 24 months respectively and this reduction was statistically significant at P-value less than 0.01.

From our study we find that the prevalence of glucose and lipid derangement in more than half of those morbid obese patients and the metabolic effect of LSG result in remission of glucose and cholesterol in 90% and 67% at the first post-operative year and nearly 98% for both at two years as shown in Table 2 below.

Table 2: Metabolic Improvement at 3, 6, 12 and 24 months of follow-up

Table 2 shows 173/306 patients (56.5%) have abnormal blood sugar rank from impaired fasting glucose to frank DM, and 230/306 (75%) have abnormal serum cholesterol ranged from borderline to hypercholesterolemia.

Discussion

There is steadily rising in the incidence of obesity, approximately 40% of the US population has been estimated to be obese by the year 2025 if the current trend continues, bariatric surgery proved significant weight loss, metabolic improvement, correction of comorbidities improve short-term and long-term outcomes, decreasing overall mortality with a marked survival advantage [19].

The Laparoscopic sleeve gastrectomy (LSG) has increased in popularity as it proved to be effective in achieving considerable weight loss in the short-term, currently, there is a trend among laparoscopic surgeons involved in bariatric surgery as LSG which proposed by some as a sole bariatric procedure [19].

American society for metabolic and bariatric surgery at 2012 noted that several matched cohort, random control studies, prospective, and case-control studies demonstrated that LSG was equivalent to or even superior to Roux-en-Y gastric bypass (RYGB) surgery as well as adjustable gastric bypass surgery in terms of weight loss, diabetic remission, improve cardiovascular risk, inflammatory marker and improvements in a variety of obesity-related comorbidities after a short and medium-term follow-up [20].

Recently there is an increase in the number of trials which demonstrate the effectiveness of sleeve gastrectomy for metabolic syndrome. Himpson reported the percentage excess weight loss (EWL) after sleeve gastrectomy as 77.5% and 57.3% at 3 and 6 years, respectively [21]. Our study show early weight reduction with 54.5% (68 to 31 kg) and 73% (68 to 18.6 kg) at 1 and 2 year which could be attributed to combined of excessive exercise after surgery.

Long-term results of LSG usually focused on weight loss. In 2004, Sjostrom [22] reported a significant body weight regain after 2 and 10 years following bariatric operations and the percentage of excessive weight loss reportedly varied widely (46%-86%), with a decline at longer follow-ups [23-26].

Generally, the Asian population is known to develop metabolic syndrome at lower BMI in comparison to their Caucasian counterpart. Studies reported that the Asian populations with type II diabetes and non-morbid obesity (BMI, 25-35 kg/m²), sleeve gastrectomy has demonstrated up to 50% remission in diabetes at 1 year [27] and our
study show remission of DM in 90% at the first year and almost all patients at 2 years.

Lipid profile improvement was significant, specifically for triglyceride and HDL levels, without effective lowering total cholesterol and LDL levels at one year after sleeve gastrectomy [28] and this contradict to our study which shows significant lower in total cholesterol from 5.6 to 5 and 4.6 mmol at 12 and 24 months respectively.

Conclusion

Sleeve gastrectomy is a safe and effective bariatric procedure with approximately 75% of the excessive weight loss achieved at the first two-years, normalized blood sugar occurs in 96% of patients with normalization of total body cholesterol in all with satisfactory long-term results regarding weight loss and co-morbidities.

Our study result show more than 50% of the obese population has dyslipidaemia and abnormal blood glucose and sleeve gastrectomy result in significant reduction in total body cholesterol which contradicts to other studies so further study regarding this issue is recommended.

Conflict of Interest

Author declares there is no any conflict of interest.

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