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Metabolic Improvement in Blood Glucose and Cholesterol after Sleeve Gastroectomy

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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 kh) 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 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.

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/m 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 mmmol 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 kh) 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.

Characteristics	Preoperative (n=306)	3 months (n=306)	6 months (n=306)	12 Months (n=306	24 months (n=306)
Age	30.5	30.5	30.5	30.5	30.5
Male/Female ratio	194/112	194/112	194/112	194/112	194/112

BMI, Mean (SD)	49.5 kg/m^2 (34.1-84.8)	46.77 kg/m^2 31.4-83	41.5 kg/m^2 (27.6 -75)	36.5 kg/m^2 (24.4-68.3)	29.9 kg/m^2 (20-57.4)
Weight, Mean (SD), kg	135 kg	123 kg	111 kg	97 kg	80 kg
Excessive weight, Mean (SD) kg	68 kg	56 kg	45 kg	31 kg	18.6 kg
Blood sugar mean (SD)	6 mmol	5.57 mmol	5.34 mmol	5 mmol	4.3
Hypercholesterolemia, No. Percentage (%)	5.568	5.24	5.22	4.97	4.3

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.

Parameters	Pre-op	3 months		6 months		12 months		24 months	
		Complete	Partial	Complete	Partial	Complete	Partial	Complete	Partial
Diabetes Mellitus	50	13/50	37/50	33/50	17/50	45/50	5/50	50/50	-
Impaired fasting glucose	123	46/123	-	70/123	-	123/123		123/123	-
Cholesterol > 5.2mmol	52	0/52	52/52	0/52	52/52	0/52	52/52	38/52	14/52
Boderline choles 5.2-6.2	178	63/178	115/178	64/178	114/178	119/178	59/178	38/52	178/178

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/m^2), 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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