Effect Of Laparoscopic Sleeve Gastrectomy On Weight Loss And Co-Morbid Factors

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Abstract

This study was undertaken to assess medium-term effects of laparoscopic sleeve gastrectomy on body weight and co-morbid factors like diabetes, hypertension, and thyroid imbalance. Forty-two obese subjects [19 male/23 female; age 23-65 yrs; BMI (Body Mass Index) 45±5 kg/m²] underwent evaluation of anthropometric/clinical parameters and blood sugar, hypertension and thyroid function tests before surgery and 9-15 months after surgery. Mean BMI decreased from 45 to 30 after 9-15 months of surgery (p=0.00001). Remission of diabetes mellitus and hypertension (p-value of 0.00001) occurred in all patients except one. In fact, sleep apnoea and asthma was cured in all 5 patients (p-value of 0.001). Out of the 5 patients with thyroid imbalance, all except one were off medication within 5 months (p=0.001). Our study showed that laparoscopic sleeve gastrectomy is effective in producing a significant and sustained weight loss (p=0.00001) and improving DM, hypertension and other co-morbid factors in obese patients.

INTRODUCTION

Obesity is one of the most serious and urgent public health problems globally because of its metabolic and cardiovascular complications that negatively impact on life expectancy[1]. Equally alarming is the increase of morbid obesity (BMI > 40 kg/m²) that tripled in developing countries like India over the last 20 years and quadrupled globally over the last two decades, whereas extreme obesity (BMI > 50 kg/m²) increased five-fold[2].

Bariatric surgery, also known as metabolic surgery, has emerged as a highly effective and long-lasting treatment in patients with morbid obesity and in those with BMI > 35 kg/m² in the presence of co-morbidities like T2DM (Type 2 Diabetes Mellitus), hypertension, thyroid imbalance and sleep apnoea[3]. There is extensive evidence that bariatric procedures, including bilio-pancreatic diversion (BPD), gastric bypass (GBP), and gastric banding, can successfully control most of the obesity-related co-morbidities. The rate of success is higher with the predominantly malabsorptive and mixed malabsorptive- restrictive procedures than purely restrictive operations.

OBJECTIVE

Laparoscopic sleeve gastrectomy (LSG) is emerging as a new promising therapy for the treatment of morbid obesity. In fact, LSG has the advantage to be less invasive than GBP and BPD, and not inferior in terms of sustained weight loss, as demonstrated in some preliminary studies. Few studies have examined the effects of LSG on co-morbidities in obese patients, and limited information is available on the long-term efficacy of this procedure. Therefore, in the present study we assessed the medium- term (9-15 months) effects of LSG on body weight and co-morbid factors not adequately controlled by medical therapy.

METHODS

An electronic data search of MEDLINE, PubMed, Scopus, Clinical Evidence, TRIP, Health Technology Database, Conference abstracts, clinical trials, and the Cochrane Library database was completed. The search terms used included LSG, bariatric surgery, metabolic surgery, and diabetes (DM), type 2 DM, or co-morbidities

The study was conducted under the Department of Bariatric Surgery at hospitals in Mumbai, where subjects were enrolled through outpatient visits in our OPD between January 2010 and December 2010. All patients selected were given 2 fair and honest trials of diet and exercise which had failed. They were being treated with insulin for diabetes and antihypertensives for hypertension.

A total of 42 obese patients (19 male/ 23 female, age 23-65 yrs, BMI 45±5 kg/m², mean ± standard deviation) with co-

morbidities like DM, hypertension, thyroid imbalance or sleep apnoea underwent LSG surgery. All patients were examined by a multidisciplinary medical team consisting of a physician, bariatric surgeon, psychiatrist, endocrinologist and dietician.

The inclusion criteria were:

Exclusion criteria were:

History of mental impairment, drug or alcohol addiction, recent major vascular event and excessive surgical risks due to debilitating diseases that considerably impair life expectancy

All patients underwent complete evaluation including nutritional status like vitamin B12, calcium, magnesium, iron, protein, fat and carbohydrate body composition before and at 9-15 months after surgery. No nutritional supplements were given before and after surgery.

Postoperatively, the patients were followed up after 1 month, 3 months, 6 months, 9 months, 1 year and 15 months. All tests including weight loss, blood sugar, blood pressure, thyroid function test, nutritional and clinical parameters were assessed regularly.

DIETARY GUIDELINES

The patients were kept on clear liquids 3 days before surgery.

After Surgery, the patients were on “nil by mouth” for 48 hours, followed by low-calorie clear liquids for 4 weeks and semisolids (low-calorie) for 2-4 weeks, followed by full diet.

Most of the patients lacked exercise and significant physical activity before surgery. After surgery, the patients were asked to resume work from day 5 and gradual exercise and physical activity from day 10, with graded increase to walking up to 6km in 1 hour over the next 2- 3 months.

All patients provided written informed consent before undergoing surgery.

OPERATIVE TECHNIQUE

All operative procedures were performed laparoscopically. The first step consisted in opening the gastrocolic ligament attached to the stomach from the pyloric vein, usually 10cm proximal to the pylorus toward the lower pole of the spleen. Then the gastric greater curvature was freed up to the cardio-oesophageal junction close to the stomach sparing the gastroepiploic vessels. Meticulous dissection was performed at the angle of His with full mobilisation of the gastric fundus. The stomach was mobilised downward toward the antrum up to 3-5cm from the pylorus. The stomach was resected with linear staplers parallel to the 40-French orogastric tube along the lesser curve starting 3-5cm from the pylorus. The orogastric bougie was then replaced by a nasogastric tube positioned in the distal stomach. Hemostasis and staple line were checked. The resected stomach was then removed through the umbilical port. The residual gastric volume ranged from 60 to 80ml.

REMISSION OF CO-MORBIDITIES

Remission of T2DM was defined as fasting plasma glucose below 100 mg% in the absence of hypoglycemic treatment. Remission of hypertension was defined as blood pressure below 130/90 mmHg in the absence of anti-hypertensive treatment. Remission of thyroid imbalance was defined as normal thyroid profile in the absence of medical therapy. Remission of sleep apnoea and asthma was defined as normal sleep and breathing without apnoeic/asthmatic spells devoid of treatment or CPAP.

STATISTICAL ANALYSIS

Results are expressed as mean ± SD (Standard Deviation) or number. ANOVA (Analysis of Variance) with repeated measures was used to detect changes over time of the anthropometric and biochemical variables. Paired Student’s t-tests were used to compare data before and after surgery. A p-value of 0.05 was considered statistically significant. All statistical analyses were performed using SPSS (Statistical Package for the Social Sciences) version 13.0 (SPSS Inc., Chicago, IL).

RESULTS

The main characteristics of the patients studied are shown in Table 1.

Figure 1

	Pre-operative	Post-operative	% Change (M/F)	p-value
Body Weight (kg)	119 ± 15.78	92.32 ± 14.59	28.7/ 44.6	0.00001
BMI (kg/m²)	45 ± 5	34 ± 5	7.30/ 13.18	0.00001
Diabetes Mellitus	3	3 cured	96/98	0.001
Hypertension	9	7 cured	76/78	0.0001
Both Diabetes and Hypertension	32	30 cured	86/91	0.00001
Sleep Apnoea	5	5 cured	100	0.00001

After an initial screen of 321 titles, 259 abstracts were reviewed, and 27 studies met the inclusion criteria and the full report was assessed. One study was excluded after a careful assessment because the investigators had combined LSG with ileal interposition.

After surgery, there was a significant reduction in the feeling of hunger which was natural, not needing any forceful control, and early satiety with limited food volume was achieved. There was no food intolerance postoperatively.

Following surgery, all patients discontinued their hypoglycemic medications, and full remission of T2DM was achieved in almost all patients. Hypertension was relieved in all but one patient and thyroid medication was continued in only 1 of 5 patients. Patients with sleep apnoea and asthma went off medications in 5 of the 5 operated patients. Most of the patients were off medications for co-morbid factors within 6-9 months following surgery in gradually reducing doses.

Average reduction of body weight was 28.7% in males and 44.6% in females. In terms of weight in kg, average weight loss was 29.59 kg in females and 25.43 kg in males, the t-value being 16.732.

Results could be more specific with HbA1c levels being measured.

DISCUSSION

Our study shows that LSG is effective in producing a significant and sustained weight loss[3] and improving the co-morbid conditions in obese patients. In fact, after 9-15 months from surgery, all patients achieved good glycemic control, thyroid function and breathing status, and all but one were cured of hypertension. This finding is in line with previous studies[11]. The results seem better in this study due to smaller sample size and measurement of clinical/anthropometric parameters and blood sugar levels only. With inclusion of larger sample sizes and HbA1c levels, the results would match with world studies on more appropriate platforms.

Although the mechanisms underlying T2DM remission following LSG has yet to be fully determined, some human studies have reported favorable changes in insulin sensitivity[12][13]. The improvement in insulin sensitivity is primarily due to weight loss, reduction in inflammatory mediators and decreased calorie intake. Potential mechanisms include enhanced stimulation of gastrointestinal hormones secondary to rearrangement of gastrointestinal anatomy. For malabsorptive/mixed procedures (RYGB - Roux en Y Gastric Bypass and BDP) relevant and rapid changes in the enterohormonal axis have been demonstrated, consisting of complete recovery of meal-stimulated response of GLP-1 (Glucagon-Like Peptide) and GIP (Glucose-Dependent Insulinotropic PolyPeptide)[1]. The recovery of incretin response is maintained over time, probably contributing to the recovery of beta-cell function. This procedure is associated with a marked reduction of ghrelin secretion, an orexigenic peptide produced by the gastric fundus involved in mealtime hunger regulation'. Ghrelin is also known to exert several diabetogenic effects (increase in growth hormone, cortisol and epinephrine); therefore its suppression could contribute to improved glucose homeostasis. Interestingly, we observed an increased meal-stimulated GLP 1 and GIP response in our patients at 3 weeks postoperatively, which may have concurred to amelioration of glucose metabolism.

The reduction in sleep apnoea relates directly to reduction in the mass of fat cells lining the alveoli, reduced pharyngeal adipose tissue as well as reduced external pressure of fatty tissue on the airways by fat being lost. The chest wall contractility improves with reduced weight.

Hypertension is reduced due to weight reduction with less total body mass to which blood needs to reach, reduced insulin resistance, reduced fat cells lining the endothelium of blood vessels, increased pliability of vessel wall (vascular compliance due to reduced sympathetic tone) and increased mobility or exercise improving cardiac reserve and stroke volume: Smooth blood flow through clear channels.

Reduction of weight and normalisation of BMI helps maintain normal thyroid function as obesity and metabolic factors play an important role especially in hypothyroid obese patients.

None of the patients studied presented any sign of nutritional deficiencies at 9-15 month follow-up, confirming that LSG is a safe procedure in terms of nutritional status at odds with malabsorptive or mixed surgical procedures which often lead to multiple nutritional consequences due to the bypass of duodenum and jejunum'.

CONCLUSION

LSG induces stable weight loss and resolution of co-morbid factors in the large majority of patients. Controlled long-term comparisons between different bariatric interventions are needed to establish the optimal procedure in relation to patient's characteristics. The study could be made more specific with a larger cohort size and measurement of HbA1c levels.

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