Effect of Sleeve Gastrectomy on Lipoprotein Metabolism in Morbidly Obese Patients

AMIR K.M. ABO SAYED, M.Sc.; AHMED H. KHALIL, M.D.; NADER M. MILAD, M.D.; SHERIF MOKHTAR, M.D.; EMAD S. KHALLAF, M.D. and MOHAMMED Sh. HATHOUT, M.D.

The Department of General Surgery, Faculty of Medicine, Cairo University

Abstract

Background: Obesity is associated with abnormal fasting and postprandial lipids, which may link obesity with atherosclerosis. We explored lipoprotein metabolism in morbidly obese patients treated with sleeve gastrectomy.

Methods: 20 hyperlipidemic cases were selectively chosen and candidate for sleeve gastrectomy at Kasr Al-Aini Hospital. Blood sample was taken from them after fasting 12 hours for assessment of lipid profile (Triacylglycerols (TG), Total Cholesterol (TC), High Density Lipoprotein (HDL) and Low Density Lipoprotein (LDL)) at time of surgery, 3 months and 6 months after surgery.

Results: 20 cases of hyperlipidemia were included in the study in the period between December 2013 and January 2015 with follow-up for 6 months up to July 2015. During the study period 20 cases of sleeve gastrectomy were done at Kasr Al-Aini Hospital with marked improvement in TG, TC and HDL with less improvement in LDL.

Conclusion: Six months after sleeve gastrectomy fasting and postprandial lipoprotein metabolism is improved in morbidly obese patients.

The potential mechanisms may relate to decreased caloric intake but also to hormonal changes.

Key Words: Sleeve gastrectomy – Lipid profile – Hyperlipidemia.

Introduction

OBESITY has reached epidemic proportions with 2.3 billion overweight adults in 2015, of which 700 million obese adults [1]. Obesity is defined as a Body Mass Index (BMI) (weight in kg divided by height in meters squared) of greater than 30 kg/m^2: It is associated with an increased risk for hypertension, dyslipidemia, type 2 diabetes, coronary heart disease, stroke, gallbladder disease, osteoarthritis, dementia, sleep apnoea and respiratory problems, and various cancers [2]. Overall mortality is increased in obese subjects with coronary heart disease being the major factor for higher mortality [3]. Lipid changes such as elevated TGs, elevated LDL-cholesterol (LDL) and low HDL-cholesterol (HDL) are typically found in obese patients and predispose to atherosclerosis [4].

Patients and Methods

This is a prospective study done in Kasr Al-Aini Hospitals in the period between December 2013 and January 2015 with follow-up for 6 months up to July 2015. 20 hyperlipidemic patients were selectively chosen and candidate for sleeve gastrectomy at Kasr Al-Aini Hospital.

Inclusion criteria:

- BMI ≥ 35 kg/m^2 with hyperlipidemia.

Exclusion criteria:

- Endocrinal causes of obesity (hypothyroid disease, cushing disease).
- Pregnancy.
- Psychologically unstable.

All patients were subjected to proper history taking and complete physical examination.

Preoperative investigations:

A- Laboratory:

- Complete blood count, coagulation profile, liver function tests, kidney function tests, fasting blood sugar, lipid profile (TG, TC, HDL, LDL).
- Hormonal assay e.g. (thyroid hormone profile): To detect any endocrinal causes of obesity.
B- **Radiological investigation:**
- Chest X-ray.
- Abdominal ultrasound to detect gall bladder stones.
- Pulmonary functions.
- Cardiac assessment (ECG & echocardiography if needed).

**Preoperative clinical evaluation and investigations aimed at assessment of:**
- Fitness for surgery.
- Associated comorbidities e.g. diabetes mellitus, chest diseases.
- Chest, cardiological, psychiatric consultations.

The goals of the preoperative assessment for bariatric surgery are to assess indications and contraindications to bariatric surgery and to control medical comorbidities before surgery. Moreover, informed consent about expected complications is signed.

**Pre-operative diet:** Carbohydrate and fat free diets for two weeks.

**Sleeve operation steps:**

The patients were placed in supine position with the arms and lower limbs spread apart. Up to knee elastic stockings were applied in addition to half therapeutic dose of low molecular weight heparin (1mg/kg) (clexane) was administered subcutaneously as a prophylactic measure against DVT. Gastric decompression was achieved by insertion of a nasogastric tube.

Pneumoperitoneum is achieved using a closed technique with a Veress needle placed in the left subcostal area of the abdomen. Five ports were applied as follows; one 10mm port just below the xyphoid process for liver retraction and another one 15-20cm below the xyphoid process for 30 degree scope, two 12mm working ports were applied in the left and the right midclavicular line in line with the camera port, and the last port 5mm was inserted at the left anterior axillary line few centimeters below the left costal margin for assistance.

Mobilization of the greater curvature of the stomach was done using the harmonic scalpel or the ligasure proximally to the gastroesophageal junction and distally 6cm proximal to the pylorus. The anaesthetist removes the nasogastric tube to insert an orogastric 40 French bougie till the first part of the duodenum. Sixty millimeter endo-gastrointestinal (GIA) stapler was used to divide the stomach along line with the bougie creating a gastric tube.

The staple line is not oversewn. Endoclips are used to control the bleeding points along the staple line. The bougie is drawn proximally up to the gastroesophageal junction and the pylorus was closed with an endoclinch. Methylene blue was injected through the bougie to detect intraoperative leakage. Nelaton drain was applied close to the staple line. The excised part of the stomach was extracted through the 12mm port.

**Postoperative care:**

Close monitoring of the vital signs, urine output and drains. Intravenous (IV) antibiotics, analgesics, Proton Pump Inhibitor (PPI) and IV fluid were administered. Subcutaneous clexane was continued. The patient is encouraged to be ambulant few hours after surgery. Gastrografin meal was done on the next day after surgery to detect any leakage. If the test is negative the patient is allowed to start oral sugar free fluids. Discharge after 48 hours in uncomplicated cases. Oral PPI as well as vitamin supplementation were prescribed. The patients were instructed to receive the appropriate diet and perform physical exercises.

Follow-up was done every 2 weeks in the outpatient clinic to monitor the weight loss and to highlight any complication. CBC, serum iron, vitamin B 12 and serum calcium as well as abdominal ultrasound (to detect gall bladder stones) were done to all patients at 6 after surgery.

**Assessments:**

Subjects who are candidate for sleeve gastrectomy are doing laboratory investigations at Kasr Al-Aini Hospital. Blood sample was taken after fasting for 12 hours for assessment of lipid profile (Triacylglycerols (TG), Total Cholesterol (TC), HDL and LDL) at:
- Before surgery.
- 3 months after surgery.
- 6 months after surgery.

**Results**

During the study period 20 cases of sleeve gastrectomy were done at Kasr Al-Aini Hospital. The age of the study population is ranged between 23 and 39 years with a mean of 29.7 years. The sex of the study population is 2 males and 18 females the range of Body Mass Index (BMI) (42.98-56.02).

49

Discussion

Unfortunately, obesity has a variety of adverse health consequences associated with a high rate of death, such as Type 2 Diabetes Mellitus (T2DM), hyperlipidemia, hypertension, Obstructive Sleep Apnea (OSA), certain types of cancer, steatohepatitis, gastroesophageal reflux, arthritis, Polycystic Ovary Syndrome (PCOS), and infertility [5].

In 2012, Hady Razak Hady and colleagues, 130 patients underwent LSG and they published their article from which they concluded that after one year post LSG, they obtained not only decrease in LDL cholesterol (20%), triglycerides (95%), and total cholesterol (40%) but also an increase in HDL cholesterol (65%) however, short-term results (before the third month after surgery) were not satisfying. Obtained results indicate that bariatric surgery may effectively influence dyslipidemia associated with obesity [6].

Strain and colleagues conducted a study including approximately the same number of patients (20 patients) as in our study, they concluded that one year after LSG, there was a significant increase of HDL cholesterol levels (72%), with a significant decrease of TG (90%) and LDL remained unchanged, while differs from our study that total cholesterol remained unchanged [7].

Similar conclusions were obtained by Wong and colleagues in their observations during 9-month study in 37 patients during which the lipid profiles were monitored, they reported a significant improvement in parameters of lipid profile after LSG. But compared with our results, they reported improvement not only in HDL (60%), TG (75%) and TC (20%) but also LDL cholesterol (20%) [8].

In 2012, Zainab A. Razak and colleagues reported that after a short period from LSG (6 months -33 patient) there is improvement in the lipid profile in hyperlipidemic patients in the form of decrease in TC cholesterol (55%), triglycerides (90%), and HDL (30%) but also LDL unchanged [9].

In 2011, Marek buzgha and colleagues summarizes that after six months post LSG, (33 patients) there was improvement in the lipid metabolism in the form of increasing HDL cholesterol level (40%) and lowering triglyceride level (85%) while neither LDL cholesterol nor total cholesterol changed in any significant way [10].

Ghrelin is an endogenous hormone that stimulates the release of growth hormone and the appetite. It plays a role in body weight regulation independent of growth hormones by initiating food intake. With LSG, loss of appetite, despite a patient's restricted hypocaloric intake, is explained by the elimination of the majority of ghrelin-producing cells by resecting and removing most

Table (1): Demographic data.

<table>
<thead>
<tr>
<th></th>
<th>Sleeve group</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range of age (years)</td>
<td>23-39</td>
<td>0.678 NS*</td>
</tr>
<tr>
<td>Gender:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>2 (10%)</td>
<td>0.661 NS*</td>
</tr>
<tr>
<td>Female</td>
<td>18 (90%)</td>
<td></td>
</tr>
<tr>
<td>Range of BMI (kg/m²)</td>
<td>42.98-56.02</td>
<td>0.0025S*</td>
</tr>
</tbody>
</table>

NS: Non-significant. S: Significant.

Table (2): Total Cholesterol (TC).

<table>
<thead>
<tr>
<th>Total cholesterol</th>
<th>Sleeve group</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normal</td>
<td>Elevated (TC)</td>
</tr>
<tr>
<td>Pre-total cholesterol</td>
<td>2 (10%)</td>
<td>18 (90%)</td>
</tr>
<tr>
<td>Post 3 months cholesterol</td>
<td>8 (40%)</td>
<td>12/18 (65%)</td>
</tr>
<tr>
<td>Post 6 months cholesterol</td>
<td>14 (70%)</td>
<td>6 (30%)</td>
</tr>
</tbody>
</table>

Table (3): Triglyceride (TG).

<table>
<thead>
<tr>
<th>Triglyceride</th>
<th>Sleeve group</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normal</td>
<td>Elevated (TC)</td>
</tr>
<tr>
<td>Pre-TG</td>
<td>10 (50%)</td>
<td>10 (50%)</td>
</tr>
<tr>
<td>Post 3 months TG</td>
<td>18 (90%)</td>
<td>2 (10%)</td>
</tr>
<tr>
<td>Post 6 months TG</td>
<td>20 (100%)</td>
<td>0/10 (0%)</td>
</tr>
</tbody>
</table>

Table (4): HDL level.

<table>
<thead>
<tr>
<th>HDL level</th>
<th>Sleeve group</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normal</td>
<td>Low HDL</td>
</tr>
<tr>
<td>Pre-HDL</td>
<td>1 (5%)</td>
<td>19 (95%)</td>
</tr>
<tr>
<td>Post 3 months HDL</td>
<td>5 (25%)</td>
<td>15 (75%)</td>
</tr>
<tr>
<td>Post 6 months HDL</td>
<td>10 (50%)</td>
<td>10/19 (52%)</td>
</tr>
</tbody>
</table>

Table (5): LDL level.

<table>
<thead>
<tr>
<th>LDL level</th>
<th>Sleeve group</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normal</td>
<td>High HDL</td>
</tr>
<tr>
<td>Pre-LDL</td>
<td>14 (70%)</td>
<td>6 (30%)</td>
</tr>
<tr>
<td>Post 3 months LDL</td>
<td>14 (70%)</td>
<td>6/6 (100%)</td>
</tr>
<tr>
<td>Post 6 months LDL</td>
<td>14 (70%)</td>
<td>6 (30%)</td>
</tr>
</tbody>
</table>
of the stomach [11]. Exogenous ghrelin increases Plasma Glucose (PG) and free fatty acids (Adipogenic hormone) with LSG reduction of the majority of ghrelin-producing cells improve hyperlipidemia [12].

In our study six months post laparoscopic sleeve gastrectomy there was a dramatic improvement on the lipid profile. The main obesity-related metabolic risk factors of cardiovascular disease involve low serum HDL cholesterol levels with increased levels of TG, total cholesterol and LDL cholesterol levels were improved in the form of an increase of HDL cholesterol (48%) and a decrease in both of TG (100%) levels and total cholesterol (66%). On the other hand, no statistically significant changes were reported in LDL cholesterol levels ($p<0.314$).

**Conclusion:**

The cost of obesity and its comorbidities is huge and bariatric surgery has proven to cut in these costs proving not only the healthcare benefit to the obese subject but rather a benefit to the economy. Six months after sleeve gastrectomy fasting and postprandial lipoprotein metabolism is improved in morbidly obese patients.

**References**

6. HADY RAZAK HADY, JACEK DADAN and MAGDALENA LUBA: The Influence of Laparoscopic Sleeve Gastrectomy on Metabolic Syndrome Parameters in Obese Patients in Own Material, 2011.