

# Effect of Sleeve Gastrectomy on the Lipid Profile of Patients with Morbid Obesity

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## ABSTRACT

Obesity is a kind of malnutrition in which excess body fat has accumulated to the extent that it may have negative effect on health. The treatment of obesity is difficult, weight loss through pharmacotherapy or dietary restrictions have shown to have short term benefits and lack long term benefits. Therefore, surgical treatment is considered as one of most effective procedure for long term perspective. Laparoscopic intervention is preferred method among bariatric surgery. Out of these Laparoscopic sleeve gastrectomy(LSG) is accepted as a primary bariatric surgery for patients with severe obesity BMI > 50kg/m<sup>2</sup> due its low risk and easier technique. We planned to evaluate the role of Bariatric Surgery in weight reduction, improved dyslipidaemia with near normo-glycemic status after sleeve Gastrectomy. The study was conducted on 50 morbid obese cases, b/w age 20-40 years with BMI > 35/kg<sup>2</sup> who agreed to undergo restrictive bariatric Surgery (sleeve gastrectomy). The study groups were further subdivided into 3 stages-1. Morbid obese subjects selected before Sleeve Gastrectomy as baseline group for serum analysis,2. Morbid obese subjects 9 weeks after Sleeve Gastrectomy,3. Morbid obese subjects 12 weeks after Sleeve Gastrectomy. The results demonstrated significant improvement in levels of parameters like total cholesterol, LDL, triglyceride and HDL at 9 weeks and 12 weeks post surgery in patients with non diabetic status. On contrary in diabetic patients these lipid parameters including serum cholesterol and TG levels didn't reveal any significant improvement at both 9 as well as 12 weeks post surgery, whereas LDL showed significant improvement at 9 weeks but not at 12 weeks. HDL levels were significantly increased at both 9 weeks and 12 weeks post surgery in diabetic patients. Improved glucose metabolism after Sleeve Gastrectomy may be mediated by an improvement in the insulin Resistance. Moreover, improved lipid metabolism after Sleeve Gastrectomy leads to increase in HDL-C and decrease in LDL-C, which can possibly reduce the risk of cardiovascular disease. Properly controlled studies with larger cohorts are necessary to elucidate the beneficial effects of bariatric surgery.

**Keywords:** Bariatric surgery, Blood glucose, Diabetes, HDL-C, Laparoscopic Sleeve gastrectomy, LDL-C, Lipid profile, Morbid obesity, Triglycerides, Total cholesterol

## INTRODUCTION

Obesity is a kind of malnutrition in which excess body fat has accumulated to the extent that it may have negative effect on health. In 2013 the American medical association classified obesity as a disease. It is now one of the leading causes of death worldwide, with increasing rates in adults and children. BMI >30kg/m<sup>2</sup> is considered

as obesity. It is a risk factor for several comorbidities like type 2 diabetes mellitus, hypertension, hyperlipidemia, obstructive sleep apnea, metabolic syndrome etc. (1,2) The treatment of obesity is difficult, weight loss through pharmacotherapy or dietary restrictions have shown to have short term benefits and lack long term benefits. Therefore, surgical treatment is considered

as one of most effective procedure for long term perspective. (3) Previous studies have demonstrated that weight reduction by 35-40 % following surgery is regarded as permanent. Studies even suggested that bariatric surgery was followed by significant improvement in comorbidities like hypertension and dyslipidemia as well as showed remissions in type 2 diabetes and metabolic syndrome. Laparoscopic intervention is preferred method among bariatric surgery.(4) Out of these Laparoscopic sleeve gastrectomy(LSG) is accepted as a primary bariatric surgery for patients with severe obesity BMI > 50kg/m<sup>2</sup> due its low risk and easier technique.(5) The positive effects of LSG not only included food intake control but it also targeted the serum levels of certain hormones like glucagon like peptide (GLP-1) , peptide YY, and ghrelin which effect the energy metabolism and lipid levels leading to obesity.(6,7)GLP1 is an appetite decreasing hormone while peptide YY and ghrelin are appetite increasing hormones, therefore any disbalance in their levels has important role in metabolic disorder. In a study comparing outcomes of LAGB and LSG, Frezza *et al.* noted that LSG provides better glucose control at 1 and 1.5 years after surgery than the LAGB, which seems to be suggestive of an important but not well understood influence of resection of the gastric fundus [8]. Several series examining the effect of Sleeve Gastrectomy on dyslipidemia have reported significant improvement in lipid profiles after bariatric surgery. There are marked reductions in LDL, increased HDL and decreased triglycerides [174]. In the Swedish Obesity Study [9], significant improvements were observed in triglyceride and HDL levels at 2 and 10 years in the surgical versus the control group. In the entire cohort, while total cholesterol was significantly different at 2 years, there was no significant difference at 10 years. However, subgroup analysis demonstrated that in the RYGB subgroup (*n* = 34) total cholesterol, triglycerides and HDL were all significantly improved at 10 years.

We planned to evaluate the role of Bariatric Surgery in weight reduction, improved dyslipidaemia with near normo-glycemic status after sleeve Gastrectomy. Obesity has been proposed as one of the most important determinants of metabolic syndrome mostly characterized by insulin resistance, hypertriglyceridemia, hypoalphaproteinemia and hypertension. Therefore, in this study we aim to study the lipid levels in obese patients before and after bariatric surgery to understand the changes in above biochemical levels.

## MATERIALS & METHODS

**Study Subjects:** The study was conducted on 50 morbid obese cases, b/w age 20-40 years with BMI > 35/kg<sup>2</sup> who agreed to undergo restrictive bariatric Surgery (sleeve gastrectomy). The study groups were further subdivided into 3 stages-1. Morbid obese subjects selected before Sleeve Gastrectomy as baseline group for serum analysis,2. Morbid obese subjects 9 weeks after Sleeve Gastrectomy,3. Morbid obese subjects 12 weeks after Sleeve Gastrectomy. The exclusion criteria included the following-Diabetes mellitus duration >10 years, hypo and hyperthyroidism, Cushing syndrome, a history of convulsions, uncontrolled psychiatric illness, liver or kidney disease, Ischemic heart disease, rheumatoid arthritis, pregnancy, use of hormonal contraception, Lipid lowering drugs (statins, fibrates) ,alcohol abuse and drug abuse. The present prospective study was conducted in Department of Biochemistry, SAIMS Medical College & P.G. Institute, with help of Bariatric surgery Department during period of April 2012 to May 2013. Ethical clearance was obtained from Institutional Ethical committee with reference to No./SAIMS/SS/12/702.

**Estimation of Serum Parameters:** After taking informed consent, 3ml peripheral venous blood was taken after 10-12 hours of fasting. Serum was separated and analysed on automated analyser (Hitachi -902) and elecsys-2010. The parameters analysed were

serum glucose, total cholesterol, triglyceride, HDL cholesterol, LDL cholesterol. The serum levels were estimated at 3 time intervals, viz pre surgical, post surgical at 9 weeks and 12 weeks respectively. Estimation of blood glucose was done by Glucose Oxidase Method, Total cholesterol was estimated by Enzymatic Method (CHOD/POD), Serum TG was measured by GPO-PAP Method, Serum HDL Cholesterol was measured by GPO-PAP Method and Serum LDL was measured by Friedewald method.

**Statistical Analysis:** Statistical analysis was done using SPSS v21, IBM, Chicago. Data was analysed using test of normality. Data was normally distributed therefore parametric test ANOVA was applied for intergroup comparison of means using Tukey's as post hoc analysis. P<0.05 was considered as statistically significant.

**RESULT**

A total of 50 obese and morbid obese both diabetic and non diabetic patients with BMI >35 kg/m<sup>2</sup> which met the inclusion and exclusion criteria and aged 20-40 years were enrolled in the study. Out of 50 patients 19

were females and 31 were males. Majority of patients were within the age group 31- 50 years (n= 37). Among 50 patients 22 were diagnosed with type 2 diabetes and 28 were non diabetic.

There was significant decrease in glucose levels (p<0.05) in both the diabetic and non diabetic patients at 9 weeks and 12 weeks post sleeve gastrectomy as compared to levels pre surgery. When lipid levels were measured among the three groups serum total cholesterol, TG and LDL levels showed significant decrease in levels at 9 weeks and 12 weeks post sleeve gastrectomy surgery for patients with non diabetic status. Contrary in diabetic patients the serum levels of total cholesterol and triglyceride did not show any significant improvement at 9 weeks and 12 weeks post surgery as compared to previous levels, on the other hand LDL levels showed significant reduction only at 9 weeks while at 12 weeks there was no significant improvement. Similarly serum HDL levels showed significant increase in levels at 9 weeks and 12 weeks in both diabetic as well as non diabetic patients post sleeve gastrectomy [Table 1]

**Table 1 showing serum levels of fasting plasma glucose, total cholesterol, triglycerides, LDL-C, HDL-C presurgery and post-surgery at 9 weeks and 12weeks.**

Parameter	Diabetic status	Pre-surgery	Post surgery follow up (9 weeks)	p value	Post surgery follow up (12 weeks)	p value
Fasting Plasma Glucose(mg/dl)	DM	208.23± 57.1	192.5±53.2	0.000*	157.64±42.7	0.000*
	Non DM	137.79±33.7	130.18±28.6	0.000*	119.14±21.4	0.000*
Total cholesterol(mg/dl)	DM	159.64±40.62	160.91±30.8	0.076	168±25.7	0.097
	Non DM	186.32±36.6	170.21±41.98	0.002*	174.57±23.74	0.034*
Triglyceride (mg/dl)	DM	155.64±68.17	144.32±74.75	0.494	164.55±68.76	0.660
	Non DM	177.57±83.71	143.61±85.4	0.016*	143.95±58.94	0.039*
LDL cholesterol (mg/dl)	DM	96.82±33.13	90.± 28.74	0.003*	91.36±26.45	0.069
	Non DM	115.75±30.99	99±31.19	0.001*	101.71±20.73	0.001*
HDL cholesterol (mg/dl)	DM	38.77±6.66	42.65±7.32	0.000*	44.78±7.69	0.000*
	Non DM	38.21±7.2	42.03±7.94	0.000*	44.13±8.34	0.000*

\*p < 0.05 taken as statistically significant.

**DISCUSSION**

The study aimed to compare the effect of Sleeve gastrectomy surgery in diabetic and non diabetic patients with morbid obesity (BMI >35 kg/m<sup>2</sup>) on the fasting plasma glucose and lipid profile levels. The results demonstrated significant improvement in levels of parameters like total cholesterol, LDL, triglyceride and HDL at 9 weeks and

12 weeks post surgery in patients with non diabetic status. On contrary in diabetic patients these lipid parameters including serum cholesterol and TG levels didn't reveal any significant improvement at both 9 as well as 12 weeks post surgery, whereas LDL showed significant improvement at 9 weeks but not at 12 weeks. HDL levels were significantly increased at both 9 weeks and

12 weeks post surgery in diabetic patients. Obesity is a significant contributing factor of metabolic syndrome which includes insulin resistance, type 2 DM, hypertension, and dyslipidemia. Dyslipidemia is associated with an increased risk for cardiovascular disease. The typical dyslipidemia of obesity consists of increased TG, FFA, decreased HDL along with dysfunction or increased LDL. Although dyslipidemia was not pronounced before caloric restriction in the cases others report a common dyslipidemia in patients with obesity and type 2 DM. (10,11) Despite the fact that dyslipidemia was only mild in the cases, serum TG and non HDL cholesterol decreased after caloric restriction in the study. The role of caloric restriction and weight loss on lipid metabolism has been described in previous studies.

Bouwman et al. studied the effect of a very low caloric diet on lipid metabolism in overweight/obese subjects and reported a significant decrease in total cholesterol and LDL-cholesterol [12]. A significant decrease in triglycerides and total cholesterol was also observed after a weight loss of 11kg in a study of Jourdan et al. [13]. Similarly, a decrease in triglycerides and non-HDL cholesterol was also observed after bariatric surgery at 9 weeks post operatively. However, the levels at 12 weeks post operatively were almost similar to that of pre-operative. Hady et al described a significant decrease in total cholesterol, triglycerides, and LDL-cholesterol in 100 obese patients 3 months after sleeve gastrectomy [14]. This study is in accordance with previous studies, significant decrease in total cholesterol, triglycerides, and LDL-cholesterol in both diabetic and non-diabetic groups was observed. In general, weight loss results in a decrease in triglycerides, LDL triglyceride, and non-HDL cholesterol [15]. The decrease in triglycerides after weight loss may result from a decrease in the hepatic LDL secretion, which may be the consequence of

a decreased substrate flux (fatty acids) for LDL production [16].

Non-HDL-cholesterol is a calculated parameter which encompasses LDL-cholesterol and remnant-cholesterol [17]. An improvement in this parameter reflects either an increase in HDL-cholesterol or a decrease in LDL and/or remnant cholesterol. In the study the improvement was mostly related to a decrease in remnant cholesterol. Although most of the previous studies reported an increase in HDL-cholesterol after weight loss, a decrease was also observed in study of Thompson et al. [18].

## CONCLUSION

Improved glucose metabolism after Sleeve Gastrectomy may be mediated by an improvement in the insulin Resistance. Moreover, improved lipid metabolism after Sleeve Gastrectomy leads to increase in HDL-C and decrease in LDL-C, which can possibly reduce the risk of cardiovascular disease. Improvement in glucose metabolism after Sleeve Gastrectomy may be at least partly explained by caloric restriction and weight loss, not specific for the type of intervention. Properly controlled studies with larger cohorts are necessary to elucidate the beneficial effects of bariatric surgery.

## Declaration by Authors

**Ethical Approval:** Approved

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**Conflict of Interest:** The authors declare no conflict of interest.

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