ORIGINAL ARTICLE

Mini Gastric Bypass Surgery in Obese Population: Impact on Lipid profile

Bariatric Surgery Series: Paper V

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ABSTRACT

Introduction

Obesity has became a significant health concern over the past decade. According to a higher body mass index (BMI), obesity enhances the probability of malignancy, type 2 diabetes mellitus, cardiac disorders, and musculoskeletal diseases. Bariatric surgery, a typical and effective surgical intervention for patients with excess body weight with concurrent medical conditions, achieves significant weight loss over a long period. Numerous studies have been conducted on the effectiveness of various bariatric surgery techniques for improving glycemic homeostasis and helping patients lose weight. However, little is known about how bariatric surgery affects the lipid profile. The study aims to determine how patients' altered BMI affects lipid parameters following OAGB/MGB surgery.

Methods

To achieve this, the longitudinal observational study was conducted from January 2021 to January 2022 among 150 patients scheduled to undergo Anastomosis Gastric Bypass Surgery. The mean age of the patients was 41.7 years, with a standard deviation of 14.7 years (mean±SD: 41.7±14.7). Among the study participants, 56 individuals (37.3%) were male, while 94 (62.7%) were female.

Objectives

Regarding comorbidities, hypertension was identified as the most prevalent condition among the enrolled patients, affecting 49.3% of them.

Results

It was observed that the levels of S. Cholesterol and S. Triglyceride showed a significant decrease after one month (Visit-1) of the bypass surgery, with a reduction of 21.8 mg/dl (95% CI=-31.9, -11.6, p=<0.001) and 14 mg/dl (95% CI=-25.5, -2.51, p=0.017), respectively

Conclusion

OAGB outcome is associated with a healthier lipid profile and enhanced weight management.

Keywords

Bariatric surgery, Obesity, inflammation, organ damage, weight loss, health benefit, renal function, liver function

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1. INTRODUCTION

In recent years, the significance of obesity as a severe health issue has increased. According to an increase in body mass index (BMI), obesity raises the chance of getting cancer,

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diabetes, cardiovascular disease, and musculoskeletal problems [1] (Figure 1). Individuals with severe obesity also develop dyslipidemia and a disproportionate lipid profile [2]. In addition to this, the risk of acquiring coronary artery disease is directly correlated with a higher body mass index (BMI), raised total cholesterol, low-density lipoprotein cholesterol (LDL), and triglycerides, and inversely linked with high-density lipoprotein cholesterol (HDL) [3].

Mini-gastric bypass (MGB), a variation of laparoscopic one-anastomosis gastric bypass (OAGB), is an excellent alternative in bariatric and metabolic surgery [4]. In numerous instances, bariatric surgery leads to long-term, sustainable reduction in weight and a resolution of illnesses brought on by morbid obesity [5]. Studies demonstrate that bariatric surgery results in permanent weight loss and modifies lipid profiles, though much is known about the potential impacts of this procedure on lipid profiles [6, 7].

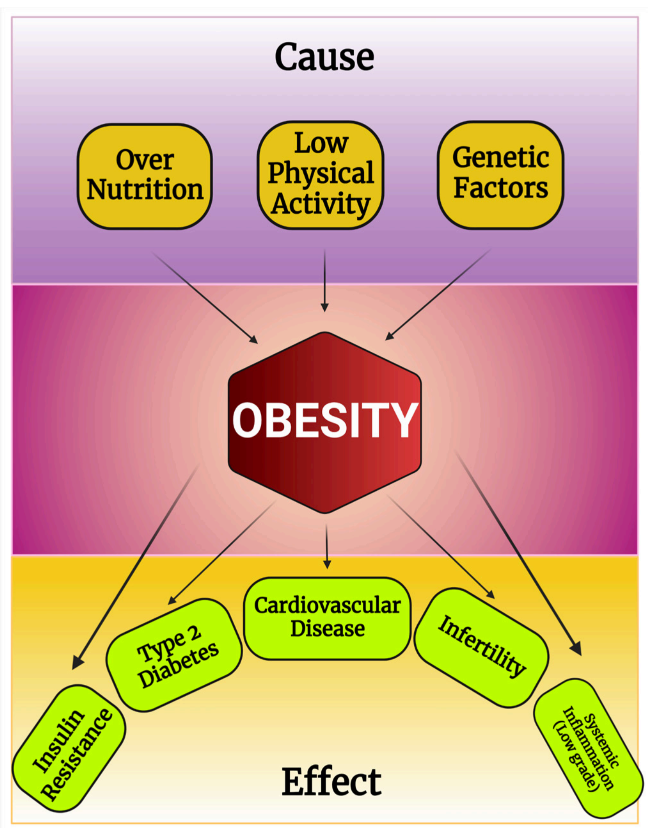

Figure 1: Schematic diagram showing the causes and effects of obesity on health. This 9th January 2023) with the license number BW26BEAMVE. Image Credit: Susmita Sinha

1.a. Role of Cholesterol in Human Health

Cholesterol is a prominent component in almost all mammalian membranes, yet it is not present in the membranes of intracellular cells and prokaryotic cells [8]. Diet and biosynthesis are the primary sources of cholesterol in the human body. Almost seventy percent of the body's everyday demand for cholesterol originates from the liver. Again, food consumption accounts for the remaining thirty percent of the cholesterol. The critical element of a cell's plasma membrane is cholesterol [9]. The chemical structure of cholesterol, which consists of a solid hydrophobic chain and a smaller polar hydroxyl group, makes it highly distinctive and suitable for use in the lipid bilayer of cell membranes. The sterol rings that constitute cholesterol are tightly bound to the hydrocarbon chains of the adjacent lipids. Thus, cell membrane fluidity is significantly influenced by its structure and how it interacts with the lipids surrounding it [10, 11].

1. b. Effects of Hypercholesterolemia on Human Health

According to recent research on animals, hypercholesterolemia can induce the onset of nonalcoholic steatohepatitis in its early stages and produce hepatocyte dysfunction and fibrosis in the liver [12, 13], a vital organ implicated in cholesterol metabolism. In context with this, it's critical to discuss how hypercholesterolemia affects adipose tissue and other utmost important organs involved in cholesterol metabolism and storage.

The primary causes of cardiovascular disease are elevated lipids and cholesterol, which narrow or calcify the arteries [14]. WHO (World Health Organization) research estimates that 56% of ischemic heart disease and 18% of cerebrovascular illnesses are caused by hypercholesterolemia around the world. In total, it causes 40.4 million DALY (disability-adjusted life year) (2.8%) and 4.4 million deaths (7.9%) [15]. According to the Multiple Risk Factor Intervention Trial, cholesterol levels of 180 mg/dl were found to be the starting point for an increase in the risk of coronary heart disease-related death. The risk multiplied once more at 200 mg/dl and quadrupled at 245 mg/dl [16].

1. c. Relation of Hypercholesterolemia with Obesity

The term "hypercholesterolemia," or high blood cholesterol concentrations, refers to cholesterol transported by lipoproteins other than HDL, and it is one of the most well-established risk factors for the onset of coronary heart disease [17]. Again, it has been demonstrated that elevated levels of circulating LDL in adipose tissue hinder TG clearance and have other adverse effects [18]. In addition, the circulating lipid content is influenced by several factors, including age, gender, and internal and external environment elements, such as hormone levels, physical activity, and nutrition [19]. Compared to other varieties of obesity where brown fat is involved and white fat is in other parts of the body, the central, abdominal, or visceral type of obesity is associated with a higher risk of developing diabetes mellitus (T2DM) and cardiovascular disease (CVD) [20].

The body's most considerable pool of cholesterol is found in adipose tissue, and human adipocyte cholesterol concentrations can reach as high as 0.5% of total lipids [21, 22]. Obesity causes adipocytes to become hypertrophied due to of an accumulation of extra triglyceride (TG) and cholesterol, followed by an irregular cholesterol distribution within the cell [23]. Consequently, these cells have been shown to have reduced plasma membrane (PM) cholesterol and enhanced fluidity. All things taken together, these cholesterol and TG overload symptoms indicate malfunctioning adipocytes [23]. Through negative feedback, cholesterol excess may influence the expression of SREBPs (sterol regulatory element-binding proteins) [24]. Diminished SREBP expression leads to decreased peroxisome PPARγ2 (peroxisome proliferator-activated receptor gamma 2), reducing the expression of downstream genes involved in forming adipocytes [25, 26].

1.d. Hypercholesterolemia and Bariatric Surgery

Low levels of HDL (high-density lipoprotein) cholesterol and high levels of triglycerides, cholesterol, and LDL (low-density lipoprotein) cholesterol are linked to obesity [27]. However, obesity, dyslipidemia, and being overweight are all controllable risk factors for cardiovascular disease [28]. The onset of coronary artery disease is greatly affected by excessive weight gain. The surgical method known as one-anastomosis gastric bypass (OAGB) helps control body weight and lowering the risk of cardiovascular disease [29]. In addition, OAGB outcome is associated with a healthier lipid profile, enhanced weight management, and a total reduction in weight of 15% to 30% [30]. A mere 5-10% reduction in body weight can enhance lipid metabolism, boosting HDL cholesterol levels while lowering LDL, total, and triglyceride levels [31]. One-anastomosis gastric bypass (OAGB) is a more advanced, minimally invasive (laparoscopic), mixed nutrition absorption reducing-restricting surgical approach in comparison to the other variety of surgery [32].

2. OBJECTIVES OF THE STUDY

The study is taken up with the objective of the consequences of BMI change on lipid parameters in patients after OAGB/MGB surgery.

3. MATERIALS AND METHODS

The materials and methods are illustrated in Figure 2.

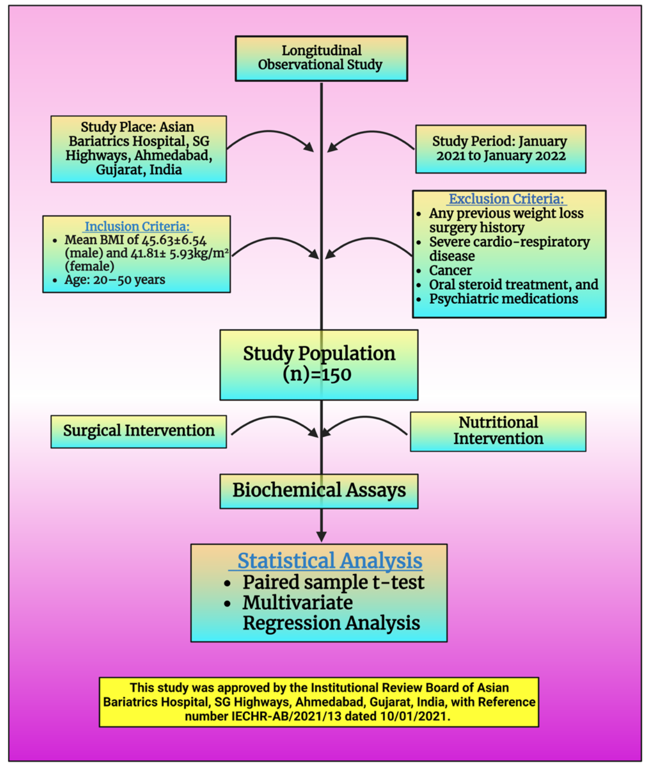

Figure 2: Illustration showing the methodology of this study. This 9th January 2023) with the license number AQ26BEGAFF. Image Credit: Susmita Sinha

3a. Study Details

Study Type: Longitudinal observational study.

Study Period: This study was conducted from January 2021 to January 2022

Sampling Type: Universal sampling was done with the patient's consent, and patients were informed about the possible benefits, side effects, and risks associated with the surgical interventions.

Study Subject: The subjects of this research were recruited from Asian Bariatrics Hospital, SG Highways, Ahmedabad, Gujarat, India

Methods of Enrollment and Randomization: Patients were enrolled between February 2021 and July 2021, and a 6-month follow-up was completed by January 2022.

Project Details: This is the fifth paper of the principal author of the Bariatric Surgery project. The earlier four (04) papers were published in the Bangladesh Journal of Medical Science (https://www.banglajol.info/index.php/BJMS/article/view/66965; https://banglajol.info/index.php/BJMS/article/view/68669; https://banglajol.info/index.php/BJMS/article/view/68665; https://doi.org/10.3329/bjms.v23i1.70666) [33-36].

3b. Sample Size Calculation

Asian Bariatrics Plus Hospital is a wide-ranging and sizeable center of obesity and metabolic surgery in India, where approximately 20-25 patients are operated on each month. Thus, to meet the required sample size of 120-150, subjects will be enrolled for 6 months and followed up for another 6 months post-bariatric surgery.

Sample Size Estimation with Single Group Mean:
N = (Zα/2)2 s2 / d2

Zα/2 = standard deviation for the two-tailed alternative hypothesis at a significance level.

S = the standard deviation obtained from the previous study or pilot.

D = the estimate's accuracy or how close to the true mean.

Zα/2=3.29; s=6; d=1.5.

The calculated sample size would be 130. If the allowance of 10% for missing, losses to follow-up, and withdrawals are assumed, then the corrected sample will be 143 subjects. The corrected sample size thus obtained is 130/ (1.0-0.10) □ 130/0.9 = 145; for 20% allowances, the corrected sample size will be 156. So, the estimated sample size preferred for this study would be 130-156 (Reference: https://pubmed.ncbi.nlm.nih.gov/29346210/) [37].

Inclusion Criteria: The age range included was between 20–50 years, belonging to both genders, with a mean BMI of 45.63±6.54 (male) and 41.81± 5.93kg/m^2 (female). Exclusion criteria: Any previous weight loss surgery history, severe cardio-respiratory disease, cancer, oral steroid treatment, and psychiatric medications, as per the recommendations indicated for bariatric surgery.

3c. Anthropometric Evaluation

Weight, height, and BMI were used for anthropometric evaluation. The patients were weighed on a Bioelectrical Impedance Machine in Body 770, and BSM 170 in body measuring scale was used for height measurements.

3d. Surgical Intervention

A laparoscopic technique was used for the surgery. A 5 mm Endopath instrument at Palmer's point was used to create the Pneumoperitoneum and the remaining 3 ports –11 mm supra-umbilical port, 12mm right of right Rectus muscle port, and 5 mm port on right hypochondrium was created. Gastroesophageal junction dissection was done by retracting the fundus and dividing the peritoneum overlying the GE junction using a Goldfinger instrument. Further, the greater omentum was divided vertically to the upper line of the transverse colon and later divided transversely. DJ flexure was identified, and a loop of a small bowel was traced to 150 cm. The loop was then pulled up in ante colic fashion and anchored to the greater curvature opposite the incisura. Dissection for the gastric pouch was started by creating a window in the lesser curve near the incisura. Subsequent stapler firing made the required stomach pouch of around 100ml. 36 Fr Gastric Calibration Tube was used. Alimentary and biliopancreatic limb measurements were 150 cm.

3e. Nutritional Intervention

The lipid profiles of subjects were examined at the baseline visit, and the same tests were repeated 3 months and 6 months after surgery. The dietary recommendation was a Very low-calorie diet (VLCD) with higher protein intake (0.8 g-1.2gper kg IBW). The diet progressed in texture over 1 month, and later, the diet was revised as per the weight loss observed over time. A balanced diet consisting of all food groups was included.

All patients in the postoperative period received commercially available mineral and vitamin supplements, per American Society of Metabolic & Bariatric Surgery (ASMBS) guidelines, 2018, after a week of surgery. At follow-up, the patients were asked about supplement compliance, dietary concerns, and complaints after surgery like gastric reflux, constipation, diarrhea, nausea, vomiting, etc.

3f. Biochemical Assays

Various biochemical tests were done on the subjects in the study to examine the lipid parameters (serum cholesterol, serum triglycerides, serum HDL, Serum VLDL, and Serum LDL).

3g. Statistical Analysis

Demographic characteristics were presented as mean±SD for continuous data and as numbers with percentages for categorical observations. To assess the mean difference of lipids between the baseline and visit-1, as well as visit-2, we conducted a paired sample t-test. Furthermore, we employed multivariate regression to examine the changes in lipids after one Anastomosis Gastric Bypass Surgery compared to the baseline. The regression model was adjusted for age, sex, history of diabetes, and hypertension. Statistical analysis was performed using STATA-15, and a graphical presentation was created using GraphPad Prism 8.3.2. A significance level of 5% (beta value = 0.05) was considered for all tests.

3h. Ethical Approval

This study was approved by the Institutional Review Board of Asian Bariatrics Hospital, SG Highways, Ahmedabad, Gujarat, India, with Reference number IECHR-AB/2021/13 dated 10/01/2021. All the study subjects verbally explained the study's intention, motive, and future scientific publication. The written informed consent was obtained before data collection commenced.

4. RESULTS

This observational study involved the inclusion of 150 patients who were scheduled to undergo Anastomosis Gastric Bypass Surgery. The mean age of the patients was 41.7 years, with a standard deviation of 14.7 years (mean±SD: 41.7±14.7).

Among the study participants, 56 individuals (37.3%) were male, while 94 (62.7%) were female. This distribution highlights a higher representation of female patients in the study cohort.

Regarding comorbidities, hypertension was identified as the most prevalent condition among the enrolled patients, affecting 49.3% of them. This was followed by obstructive sleep apnea syndrome (OSAS) at 32.7% and a history of diabetes at 29.3%. Additional comorbidities, such as dyslipidemia and hypothyroidism, were present in 20.7% and 16.7% of the patients, respectively (Table 1).

Table 1: Demographic characteristics of the study participants

Factors	Observation
Age	41.7±14.7
Sex	
Male	56(37.3%)
Female	94(62.7%)
H/O Diabetes	44(29.3%)
H/O Hypertension	74(49.3%)
H/O OSAS	49(32.7%)
H/O Dyslipidemia	31(20.7%)
H/O Hypothyroidism	25(16.7%)

Data were presented as mean±SD or number with percent in the parenthesis.

Table 2: Difference in outcome biomarkers level before and after one Anastomosis Gastric Bypass Surgery.

	Baseline	Visit-1	p-value	Visit-2	p-value
S. Cholesterol, (mg/dl)	184.1±54.2	159.6±36.9	<0.001	169.9±30.6	0.014
S. Triglyceride, (mg/dl)	128.9±50.0	113.2±38.0	0.002	123.3±44.5	0.392
HDL, (mg/dl)	44.1±7.68	44.7±8.24	0.436	47.4±15.2	0.040
LDL, (mg/dl)	95.1±36.8	93.4±33.4	0.656	99.8±26.8	0.261
VLDL, (mg/dl)	26.3±10.2	23.0±9.94	0.009	26.0±11.9	0.822

Notes: Data was presented as mean±SD. A paired sample t-test was used to estimate the p-value, and the comparison was between baseline with visit-1 and visit-2.

Serum cholesterol levels showed a significant decrease from baseline (184.1±54.2 mg/dl) to Visit-1 (159.6±36.9 mg/dl, p<0.001), but at Visit-2, there was a slight increase in cholesterol levels (169.9±30.6 mg/dl, p=0.014) (Figure 1A). Serum triglyceride levels decreased significantly from baseline (128.9±50.0 mg/dl) to Visit-1 (113.2±38.0 mg/dl, p=0.002) Figure 1B). However, at Visit-2, the levels remained relatively unchanged (123.3±44.5 mg/dl, p=0.392). HDL cholesterol levels did not exhibit significant changes between baseline (44.1±7.68 mg/dl), Visit-1 (44.7±8.24 mg/dl, p=0.436), and Visit-2 (47.4±15.2 mg/dl, p=0.040) Figure 1C). VLDL cholesterol levels decreased significantly from baseline (26.3±10.2 mg/dl) to Visit-1 (23.0±9.94 mg/dl, p=0.009), but at Visit-2, the levels remained relatively unchanged (26.0±11.9 mg/dl, p=0.822) (Table 2 and Figure 1D).

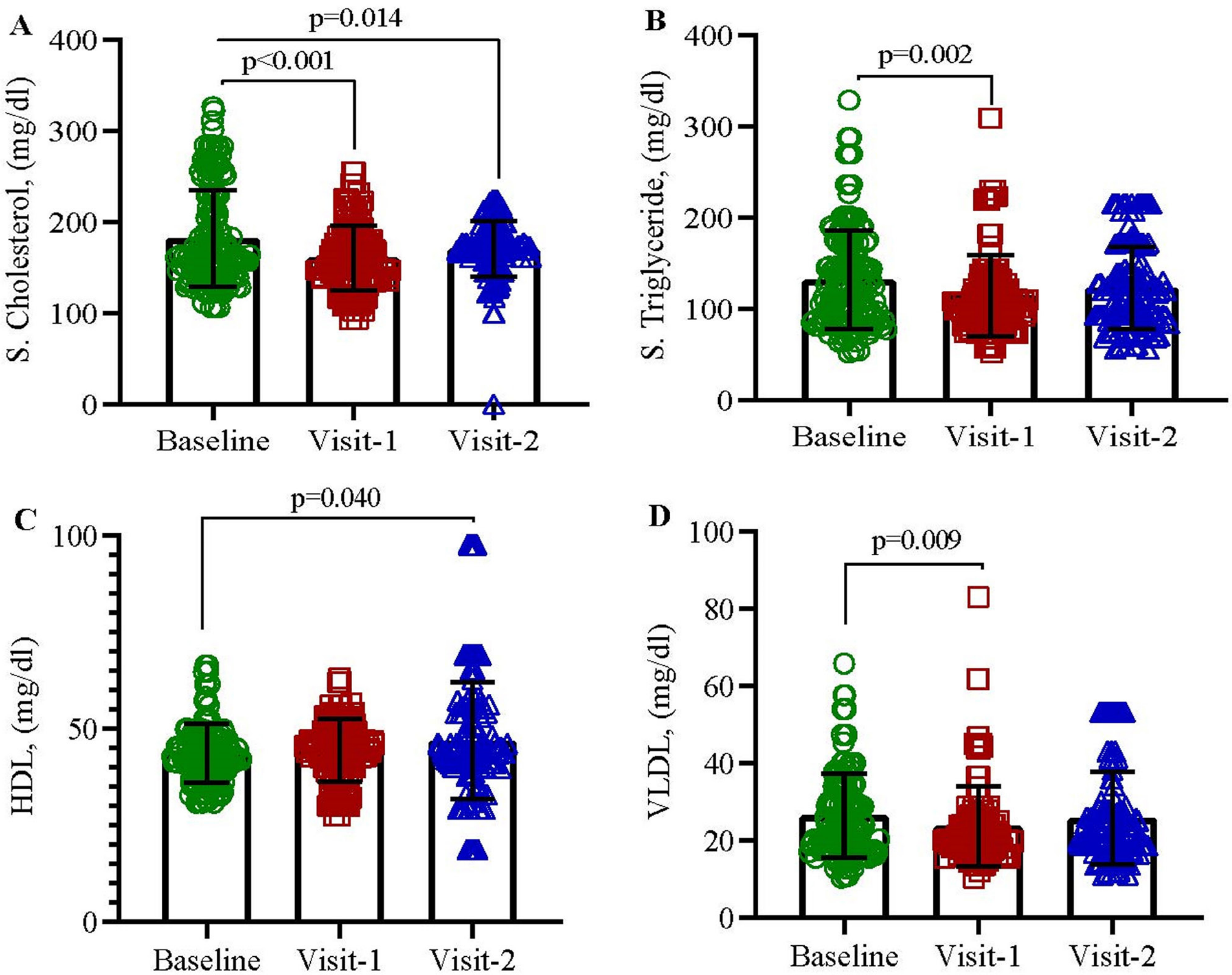

Figure 3: Difference in studied biomarkers after one Anastomosis Gastric Bypass Surgery. Paired sample t-test was applied to see the difference between baseline with follow-ups 1 & 2.

After performing one Anastomosis Gastric Bypass Surgery, the post-oerative association was compared to the pre-operation status. It was observed that the levels of S. Cholesterol and S. Triglyceride showed a significant decrease after one month (Visit-1) of the bypass surgery, with a reduction of 21.8 mg/dl (95% CI=-31.9, -11.6, p=<0.001) and 14 mg/dl (95% CI=-25.5, -2.51, p=0.017), respectively. However, no significant association was observed at Visit-2 (Table 3)

5. DISCUSSION

Bariatric surgery has demonstrated efficacy in attaining noteworthy weight loss and alleviating or curing obesity-associated comorbidities. Research has shown that OAGB is a successful substitute for diet and exercise. The post-operative total and LDL cholesterol values were significantly reduced in the current patients. Serum cholesterol levels showed a significant decrease from baseline (184.1±54.2 mg/dl) to Visit-1 (159.6±36.9 mg/dl, p<0.001), serum triglyceride levels decreased significantly from baseline (128.9±50.0 mg/dl) to Visit-1 (113.2±38.0 mg/dl, p=0.002), and VLDL cholesterol levels decreased significantly from baseline (26.3±10.2 mg/dl) to Visit-1. At 6 and 12 months following various types of bariatric surgery, other authors report a significant decrease in total cholesterol, LDL cholesterol, and triglycerides, along with an increase in HDL cholesterol. The best results were obtained with RYGB (reduction restriction), though these may not be as good as those achieved with the

Table 3. The effect of after one Anastomosis Gastric Bypass Surgery on biomarkers between follow-up and pre-operation.

	S. Cholesterol		S. Triglyceride		HDL		LDL		VLDL	
	β (95% CI)	p-value	β (95% CI)	p-value	β (95% CI)	p-value	β (95% CI)	p-value	β (95% CI)	p-value
Time										
Pre-operation	Ref.		Ref.							
Visit-1	-21.8(-31.9, -11.6)	<0.001	-14.0(-25.5, -2.51)	0.017	0.22(-2.45, 2.88)	0.874	-0.37(-8.04, 7.29)	0.924	-1.70(-4.40, 1.01)	0.220
Visit-2	-9.91(-22.1, 2.32)	0.112	-2.44(-16.5, 11.6)	0.734	2.55(-0.65, 5.74)	0.118	6.85(-2.43, 16.1)	0.148	1.31(-2.06, 4.68)	0.445

Notes: A multivariate regression model was used to estimate the p-value, and the regression model was adjusted by age, sex, H/O diabetes, and hypertension.

current OAGB technique. A future comparison of the longer-term outcomes might be intriguing: [32, 38, 39, 40].

After performing one Anastomosis Gastric Bypass Surgery, the post-operation association was compared to the pre-operation status. It was observed that the levels of S. Cholesterol and S. Triglyceride showed a significant decrease after one month (Visit-1) of the bypass surgery, with a reduction of 21.8 mg/dl (95% CI=-31.9, -11.6, p=<0.001) and 14 mg/dl (95% CI=-25.5, -2.51, p=0.017), respectively. The latest study evidence has shown that bariatric/metabolic surgery significantly improves lipid profiles and resolves dyslipidemia; however, most of these trials have small sample sizes, short follow-up periods, and/or heterogeneous treatment protoc

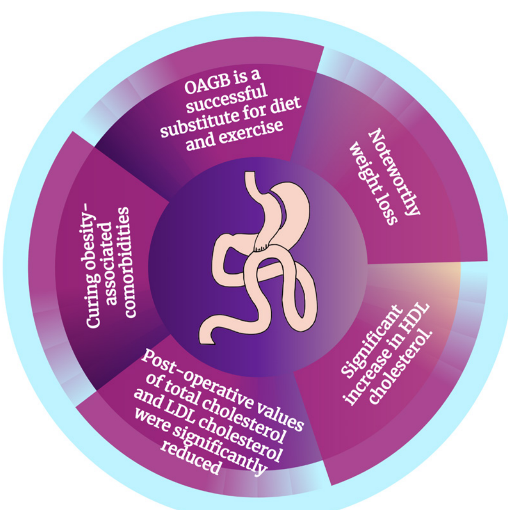

Figure 4: Illustration showing the beneficial outcomes of one anastomosis gastric bypass (OAGB) surgery. This 9th January 2023) with the license number EK26BEITYA. Image Credit: Susmita Sinha

6. CONCLUSION

Numerous risk factors and effects are similar between hyperlipidemia and obesity. The possibility of developing hyperlipidemia can be increased by obesity itself, which is associated with a more significant percentage of deposits of adipose tissues. Impairments in the metabolism, inflammation, and insulin resistance are all triggered by obesity. Again, sedentary living, or a lack of exercise, increases the likelihood of developing hyperlipidemia and obesity. The chances of acquiring obesity and high cholesterol can be reduced by maintaining a healthy weight for one's body through exercise and eating a balanced diet.

7. RECOMMENDATION

It is possible to conduct more research with a larger sample size. The majority of people who suffer from obesity need to be enlightened about the prospective outcomes of bariatric surgery because these advantages go beyond weight loss.

Consent for Publication

The author reviewed and approved the final version and has agreed to be accountable for all aspects of the work, including any accuracy or integrity issues.

Disclosure

The author declares that they do not have any financial involvement or affiliation with any organization, association, or entity directly or indirectly with the subject matter or materials presented in this editorial. This includes honoraria, expert testimony, employment, ownership of stocks or options, patents, or grants received or pending royalties.

Data Availability

The data is available from the principal author for research purposes only.

Authorship Contribution

All authors contributed significantly to the work, whether in the conception, design, utilization, collection, analysis, and interpretation of data or all these areas. They also participated in the paper's drafting, revision, or critical review, gave their final approval for the version that would be published, decided on the journal to which the article would be submitted, and made the responsible decision to be held accountable for all aspects of the work.

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