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Lipid Profile Status in Patients with Non-Alcoholic Fatty Liver Disease after Bariatric Surgery

Shagazatova Barno Khabibullaevna[1], Rakhimova Sitora Khikmatovna[2]

[1]MD, DSc, Professor, Tashkent Medical Academy, Tashkent, Uzbekistan
[2]Basic Doctoral Student, Tashkent Medical Academy, Tashkent, Uzbekistan

Abstract This study is dedicated to analyzing the lipid profile status in patients with non-alcoholic fatty liver disease (NAFLD) in the context of bariatric surgery. Obesity is associated with insulin resistance and a pro-inflammatory state, which contributes to the development of atherogenic dyslipidemia. The aim of the study was to evaluate changes in the lipid profile in patients with morbid obesity before and after gastric bypass and sleeve gastrectomy. The study included 44 patients who were treated in the endocrinology department of TMA and Medion Family Hospital from 2022 to 2024. The evaluation was based on biochemical indicators and lipid profiles before and after surgery. The results showed significant improvement in the lipid profile and reduction in atherogenicity 24 months after surgical intervention, confirming the high effectiveness of these methods in improving metabolic parameters in obese patients.

Keywords Obesity, Non-alcoholic fatty liver disease, Bariatric surgery, Gastric bypass, Sleeve gastrectomy, Lipid profile, Insulin resistance, Metabolic disorders

1. Introduction

Obesity is a global public health problem, significantly increasing the risk of developing various metabolic and cardiovascular diseases. According to data obtained from a review conducted by Huaizhu Wu and C. Ballantyne, obesity leads to insulin resistance and chronic inflammation affecting various tissues, including adipose, skeletal muscles, liver and brain [13]. Studies have repeatedly confirmed the association of obesity with the presence of insulin resistance in peripheral tissues and a pro-inflammatory condition caused mainly by the release of various cytokines and hormones by adipose tissue [7]. These factors contribute to the development of atherogenic dyslipidemia, characterized by low levels of high-density lipoprotein cholesterol (HDL), hypertriglyceridemia and elevated levels of low-density lipoprotein cholesterol (LDL).

In the context of the growing prevalence of morbid obesity and concomitant disorders of carbohydrate metabolism, surgical methods of treatment, such as gastric bypass surgery and drainage resection, are becoming more and more in demand. The effectiveness of these methods in relation to changes in the lipid profile has been evaluated in various studies. For example, a study conducted by K. Herzog and colleagues showed that Roux-en-Y gastric bypass (RYGB) causes significant changes in lipid metabolism, which indicates a significant effect of surgery on the metabolic profile of patients [6]. The study by M. Piché and the College analyzed the implementation of various methods of bariatric surgery on the lipid profile and lipoprotein metabolism. The author noted a significant improvement in the lipid profile, including a decrease in total cholesterol, LDL and triglycerides, as well as an increase in HDL levels after surgery (Piché et al., 2021).

The introduction of bariatric surgery in obese people in Uzbekistan determined the purpose of our study - to study the state of the lipid profile against the background of surgical interventions.

The purpose of the study. To study the state of the lipid profile in patients with morbid obesity before and after bariatric surgery in Uzbekistan.

2. Materials and Methods

The number of examined patients was 44 patients who were on inpatient and outpatient treatment at the Department of Endocrinology of TMA and CHK Medion Family Hospital, where surgical interventions were performed, in the period from 2022 to 2024. The age of the patients was 38.59±8.77 years. There were 4 men (9.1%) and 40 women (90.9%). The average weight of the patients was 108.88±15.70 kg, and the BMI before surgery was 40.19±5.97 kg/m2.

The patients were divided into two groups depending on the method of surgery:

- ✓ Gastric bypass (n=19.44%)
- ✓ Drain resection (n=25.56%)

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Patients taking hypolipidemic drugs were excluded from the study. The indication for the type of surgical intervention was the presence of morbid type of obesity or impaired carbohydrate metabolism in patients.

The patients underwent a liver examination using a fibroscan. In the same group, along with studying the condition of the liver, we also analyzed the lipid profile in groups of patients with different surgical approaches.

All patients underwent general clinical research methods, including assessment of lipid metabolism, both before and after surgery.

The analysis of the lipid profile was carried out in the laboratory of the Department of Endocrinology THERE and the CHEKA Medion Familia Hospital. The following parameters were measured: total cholesterol, low-density lipoprotein cholesterol (LDL), high-density lipoprotein cholesterol (HDL), very low-density lipoprotein cholesterol (VLDL), triglycerides (TG), the atherogenicity index was calculated.

The follow-up period of the patients was 24 months. Statistical data analysis was performed using the IBM® SPSS Statistics 25.0 software package. The normality of the data distribution was checked using the Kolmogorov-Smirnov test. The Mann-Whitney criterion and the Fisher exact criterion were used for comparative analysis. Quantitative data were presented as an average value ± standard deviation. The differences were considered statistically significant at a significance level of $p < 0.05$.

3. Results and Discussion

Our study involved 44 patients, of whom 90.9% were women and 9.1% were men. The average age of the participants was 38.59 years, the average weight was 108.88 kg, and the average body mass index (BMI) before surgery was 40.19 kg/m2. The patients were divided into two groups depending on the type of surgery: gastric bypass and drainage resection. The dynamics of BMI changes showed a significant decrease in BMI in the group of patients who underwent surgical resection (Table 1).

A decrease in BMI occurred by 63.2% after surgery (P<0.01).

Table 1. Indicators of the degree of liver fibrosis and BMI in obese patients before and after resection after 24 months

Parameters (n=25)	Before the operation (M±SD)	After the operation (M±SD)	P
E (kPA)	10,35±2,47	5,79±1,83	P<0,001
CAP (dB/m)	341,60±41,35	225,76±61,11	P<0,001
BMI	40,74±6,14	25,76±2,68	P<0,001

Note: the differences were compared between the groups, before and after surgery, respectively. * - P<0,05, ** - P<0,001

In order to assess the condition of the liver, a fibroscan study was conducted in individuals with different types of surgical interventions. As shown in Table 1, in patients who underwent gastric sleeve resection, BMI decreased from 40.74±6.14 to 25.76±2.68 (P<0.001). This was accompanied by significant improvements in liver fibrosis markers: the elasticity value (E) decreased from 10.35±2.47 to 5.79±1.83 (P<0.001), and the controlled attenuation parameter (CAP) decreased from 341.60±41.35 to 225.76±61.11 (P<0.001). These data confirm the high efficiency of sleeve gastric resection in reducing obesity and improving the condition of the liver. The work of E. Murakami and colleagues demonstrated that sleeve gastric resection in Japanese patients with morbid obesity led to significant improvements in clinical and histological parameters associated with non-alcoholic steatohepatitis (NASH) a year after surgery. The indicators of steatosis improved in 81.8% of patients, and the activity index of liver disease decreased in 90.9% [8].

Table 2 shows the results for patients who underwent gastric bypass surgery. There is also a significant decrease in BMI from 39.47±5.84 to 24.84±1.59 (P<0.001). Indicators of liver fibrosis have also improved: The elasticity value (E) decreased from 8.76±0.27 to 5.92±0.56 (P<0.001), and the CAP decreased from 363.00±10.65 to 221.95±11.23 (P<0.001). These results demonstrate the effectiveness of gastric bypass surgery in reducing liver fibrosis and reducing body weight. The work carried out by E. C. Smith Sandvik and colleagues showed that Roux-en-Y gastric bypass (RYGB) leads to a significant decrease in fibrosis rates 11.6 years after surgery. In their study, the proportion of patients with advanced fibrosis decreased from 24% to 14%, which confirms the long-term positive effects of surgery [9]. In addition, the analysis conducted by K. A. Seeberg and colleagues demonstrated that RGB and sleeve gastric resection (SG) led to a significant reduction in liver fat and improved fibrosis a year after surgery. In their work, the decrease in the proportion of fat in the liver was significant: for SG -19.7% and for RYGB -21.5% [10]. A review by D. Toman and colleagues showed that a year after bariatric surgery, including RGB, there was a significant improvement in NAFLD and FIB-4 indicators, which indicates a positive effect of surgery on the liver [12]. A study conducted by K. A. Seeberg and his team demonstrated that both sleeve gastric resection (SG) and Roux-en-Y gastric bypass (RYGB) lead to a significant reduction in liver fat and improved fibrosis a year after surgery. The decrease in the proportion of fat in the liver was significant and similar for both procedures: for SG -19.7% (95% CI, -22.5% to -16.9%) and for RYGB -21.5% (95% CI, -24.3% to -18.6%) [10]. In addition, a study by M. Borges-Canha and colleagues showed that a year after bariatric surgery, including sleeve resection of the stomach, there was a significant decrease in transaminase and gamma-glutamyltransferase (GGT) levels, as well as an improvement in FLI and BARD indicators, which confirms the positive effect of surgery on the liver [2].

Table 2. Indicators of the degree of liver fibrosis and BMI in obese patients before and after gastric bypass surgery

Parameters (n=19)	Before the operation (M±SD)	After the operation (M±SD)	P
E (kPA)	8,76±0,27	5,92±0,56	P<0,001
CAP (dB/m)	363,00±10,65	221,95±11,23	P<0,001
BMI	39,47±5,84	24,84±1,59	P<0,001

Note: Differences were compared between groups, before and after surgery, respectively. * - P<0,05, ** - P<0,001

The conditions of the lipid profile in patients who underwent gastric drain resection are presented in Table 3. The level of total cholesterol decreased from 5.24±0.75 to 4.19±0.74 (P<0.001), LDL - from 3.48±0.67 to 2.55±0.73 (P<0.001), triglycerides - from 1.27±0.43 to 0.95±0.33 (P<0.001). Также наблюдалось увеличение уровня ЛПВП с 1,01±0,44 до 1,16±0,45 (P<0,001) и снижение индекса атерогенности с 5,04±2,36 до 3,03±1,36 (P<0,001). These data confirm the positive effect of drain resection on the lipid profile of patients. The work carried out by Kerim Guzel and S. Şahin showed that gastric sleeve (SG) with transit bibatch (TBS) leads to significant improvements in lipid profile at 3 and 12 months after surgery. Total cholesterol, triglycerides, and LDL levels decreased significantly, and HDL levels increased compared to baseline [5]. Similarly, a study by S. Bettini and colleagues found that 18 months after laparoscopic gastric resection (LSG) drain, there was a significant improvement in the lipid profile. Total cholesterol, LDL, and triglyceride levels decreased, and HDL levels increased, confirming the positive effect of surgery on lipid metabolism [1]. In a study conducted by M. Zaki and colleagues, it was shown that 12 weeks after SG, there was a significant decrease in triglyceride levels and an increase in HDL levels. Total cholesterol and LDL levels also decreased, although the changes were not statistically significant. [14] Work conducted by Laura Abellán Garay and her team showed that 60 months after gastric resection (SG) drains, HDL levels increased significantly and triglyceride levels decreased. These data confirm the long-term positive effect of SG on the lipid profile of patients [3].

Table 3. Lipid profile indicators in obese patients before and after sleeve resection

Parameter	Before surgery (M±SD)	After the surgery (M±SD)	P
Cholesterol	5,24±0,75	4,19±0,74	P<0,001
LDL	3,48±0,67	2,55±0,73	P<0,001
HDL	1,01±0,44	1,16±0,45	P<0,001
VLDL	0,75±0,41	0,48±0,27	P<0,01
TG	1,27±0,43	0,95±0,33	P<0,001
Atherogenicity index	5,04±2,36	3,03±1,36	P<0,001

Note: Differences were compared between groups, before and after surgery, respectively. * - P<0,05, ** - P<0,001

During gastric bypass grafting (Table 4), the level of total cholesterol decreased from 5.57±1.31 to 4.30±1.15 (P<0.001), LDL — from 3.56±0.99 to 2.48±0.82 (P<0.001), triglycerides — from 1.44±0.63 to 1.10±0.47 (P<0.001). HDL increased from 1.03±0.46 to 1.16±0.35 (P<0.01), and the atherogenicity index decreased from 5.02±1.98 to 2.83±0.89 (P<0.001). These results highlight the effectiveness of gastric bypass in improving lipid profiles and reducing cardiovascular risks. Similar data were obtained in a study conducted by Kerim Guzel and M. Ikizek, where 12 months after mini-gastric bypass grafting (MGB), there was a significant decrease in total cholesterol, LDL, and triglyceride levels, as well as an increase in HDL levels. These changes indicate a positive effect of surgery on the lipid profile and a reduced risk of cardiovascular disease [4]. In addition, an analysis by S. Bettini and colleagues showed that 18 months after monoanastomosis gastric bypass (OAGB), there was a significant improvement in the lipid profile. Total cholesterol, LDL, and triglyceride levels decreased, and HDL levels increased, confirming the positive effect of surgery on lipid metabolism [1]. Similar results were obtained in a study by J. Jiménez and colleagues, which showed that 24 months after OAGB, patients experienced a significant decrease in total cholesterol, LDL, and triglyceride levels, as well as an increase in HDL levels. These data confirm the long-term positive effect of OAGB on the lipid profile and a reduced risk of cardiovascular disease (Jiménez et al., 2020). The work of F. Sinturel et al. also confirmed that one year after gastric bypass, the levels of phospholipids and sphingolipids in blood serum and subcutaneous adipose tissue changed significantly, indicating a significant improvement in lipid metabolism in morbidly obese patients [11].

Table 4. Lipid profile indicators in obese patients before and after gastric bypass grafting

Parameter	До операции (M±SD)	Before surgery (M±SD)	P
Cholesterol	5,57±1,31	4,30±1,15	P<0,001
LDL	3,56±0,99	2,48±0,82	P<0,001
HDL	1,03±0,46	1,16±0,35	P<0,01
VLDL	0,99±0,56	0,66±0,37	P<0,001
TG	1,44±0,63	1,10±0,47	P<0,001
Atherogenicity index	5,02±1,98	2,83±0,89	P<0,001

Note: Differences were compared between groups, before and after surgery, respectively. * - P<0,05, ** - P<0,001

These significant improvements in BMI, fibrosis markers, and lipid profile in both surgical groups highlight the key role of bariatric surgery in the treatment of obesity and related metabolic disorders. The results show that the benefits of these surgeries go beyond simple weight loss, contributing to improved liver function and a reduced risk of cardiovascular disease. Comparable results between gastric sleeve and gastric bypass suggest that both methods are highly effective in achieving these positive changes.

The results of this study highlight the significant positive impact of bariatric surgery on obese patients, especially in gastric sleeve and gastric bypass surgery. The study systematically evaluated changes in liver fibrosis markers, BMI, and lipid profile, revealing significant improvements after surgery.

Although this study provides strong evidence of the effectiveness of bariatric surgery in improving the health of obese patients, further long-term studies are needed to assess the sustainability of these improvements and monitor possible complications.

4. Conclusions

Our study confirms the significant positive effect of bariatric surgery on the lipid profile and overall metabolic status of patients with morbid obesity and non-alcoholic fatty liver disease.

Both gastric bypass and drainage resection resulted in significant improvements in the lipid profile, including a decrease in total cholesterol, LDL and triglycerides, as well as an increase in HDL levels. These changes contribute to reducing the risk of cardiovascular diseases and improving the overall metabolic status of patients.

Thus, bariatric surgery is an effective method of treating morbid obesity, contributing to theimprovement of both the lipid profile and the overall metabolic state of patients.

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