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ASSESSMENT OF SERUM LIPID PROFILE AND FASTING BLOOD GLUCOSE LEVELS IN PATIENTS WITH GALLSTONE DISEASE BEFORE AND AFTER LAPAROSCOPIC CHOLECYSTECTOMY

General Surgery

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ABSTRACT

Background: Gallstone disease is one of the most prevalent gastrointestinal diseases worldwide. Gallstones association has been most consistently found with high levels of triglycerides and low HDL. This study was undertaken to compare serum lipid parameters and blood glucose levels in patients of GSD and to study the effect of cholecystectomy. **Materials And Methods:** A prospective longitudinal study was carried out between May 2022 and March 2024 on patients of both sexes diagnosed with cholelithiasis aged 18-65 years and planned for laparoscopic cholecystectomy. A proforma especially designed for this study was used to record relevant information for each individual patient. Blood samples were collected from all subjects and sent for lipid profile and fasting blood glucose. Data collected were analyzed, and the results were interpreted accordingly. **Results:** This study shows that the mean value of total cholesterol, triglycerides, LDL cholesterol, and VLDL cholesterol were significantly lower than the preoperative value. HDL cholesterol increased postoperatively. This study shows that the mean value of fasting blood sugar level in the postoperative period was significantly higher than the preoperative value but within the normal limit. **Conclusion:** Females were predominantly affected by gallstone disease. From the study, it can be concluded that after cholecystectomy, there is a decrease in serum total lipids, serum cholesterol, serum LDL cholesterol, and serum triglycerides, alongside an increase in serum HDL cholesterol.

KEYWORDS

Gallstone disease, Cholecystectomy, lipid profile, fasting glucose

INTRODUCTION:

Gallstone disease is one of the most prevalent gastrointestinal diseases with worldwide distribution and a substantial burden on the health-care delivery system.[1] Gallstones continue to be one of the major health problems in the world today, although the exact number of patients is unknown because there are no signs and symptoms related to the disease when there are no complications. The majority of the patients are diagnosed incidentally.[2]

Cholesterol supersaturation of bile is the most significant factor.[3] Cholesterol is insoluble in water and secreted from the canalicular membrane in a unilamellar phospholipid vesicle. Cholesterol solubility in bile requires adequate amounts of bile salts and phospholipids, primarily phosphatidylcholine (lecithin). Excess cholesterol or decreased levels of phospholipids and bile acids can lead to the formation of multilamellar vesicles. These vesicles promote the nucleation of cholesterol crystals, which ultimately results in gallstone formation.

Additionally, gallbladder dysmotility contributes to the aggregation of cholesterol crystals, while delayed transit times in the large bowel facilitate the reabsorption of deoxycholic acid. Surgical resection of the ileum can further deplete the bile acid pool, exacerbating these mechanisms of gallstone formation.[4]

It has been reported that females are at 2-3 times higher risk for gallstone disease as compared to males, probably owing to the role of steroid hormones, and also, the risk increases as the number of pregnancies increases.[5] It is generally reported that people have a diet rich in saturated fats and a reduced intake of fiber content in the diet. Also, age, ethnicity, gender, and sedentary lifestyle play an important role in increasing the risk for cholelithiasis.[6]

Gallstones association has been most consistently found with high levels of triglycerides and low HDL, whereas it is inconsistent with low-density lipoprotein (LDL) and total cholesterol levels.[7] Gall bladder disease is more common in patients with hyperlipidemia type IV.[8]

The association between gallstones and altered lipid profile and later increase in risk of coronary artery disease, stroke, and even hepatocellular carcinoma (HCC) has been shown in many studies.[9,10,11] However, there is a paucity of information regarding the effects of cholecystectomy on serum lipid profile parameters and blood glucose levels in patients with gallstone disease (GSD) in Northeast India. Therefore, this study was undertaken to compare some serum lipid

parameters, including total cholesterol (TC), HDL-C, LDL-cholesterol (LDL-C), TG level, and blood glucose levels in patients of GSD, and to study the effect of cholecystectomy on the same.

MATERIALS AND METHODS:

A prospective longitudinal study was carried out in the Regional Institute of Medical Sciences, Imphal, Manipur, between May 2022 and March 2024 on patients of both sexes diagnosed with cholelithiasis of age 18-65 years and planned for laparoscopic cholecystectomy. Exclusion criteria were patients on lipid-lowering agents and anti-diabetic drugs, immunocompromised and on steroid therapy, pregnant women, patients with other comorbidities like renal failure, nephrotic syndrome, pancreatitis, cardiac failure, morbid obesity, hypothyroidism, sickle cell diseases, hemoglobinopathies or other acute infection. The sample size was calculated as N=(+)^2 ^{2} / ^{2}, where =1.96 at a 95% confidence level, =0.84 at 80% power, Standard deviation (SD) of the difference taken as 15.18 and effect size (E) taken as 4. Hence, the sample size for the study was 113 patients. Independent variables were age and sex. Outcome variables were total cholesterol (TC), HDL- cholesterol, LDL- cholesterol, triglyceride (TG), and fasting blood glucose. A proforma designed for this study was used to record relevant information for each patient. Statistical analysis was performed using SPSS software 21 version (IBM). Summarizations of data for age, gender, and religion were carried out by using descriptive statistics such as mean, standard deviation, and percentages. A paired t-test was used to compare changes in fasting blood glucose and lipid profile parameters from pre-operative levels to 1st, the 3rd, 7th day, and one-month post-cholecystectomy. A P-value of less than 0.05 was taken as statistically significant.

Ethical approval was obtained from the Research Ethical Board (REB), Regional Institute of Medical Sciences (RIMS), Imphal. Informed written consent was obtained from the patient and responsible attendant(s). Blood samples were collected from all subjects in this study using an antecubital venipuncture. Collected data were checked for completeness and consistency before the patient's discharge, and necessary rectifications were made. The study was self-sponsored, and there was no conflict of interest.

RESULTS AND OBSERVATION:

113 patients of cholelithiasis underwent laparoscopic cholecystectomy, Out of which 33 (29.2%) were males and the remaining 80 (70.8%) were females (Figure 1). The mean age of male patients (44.03±12.39 years) was higher than female patients (36.70±12.24 years), and the difference was found to be statistically significant with a p-value of 0.005. The age group 31 to 45 years has the maximum number of patients (38.1%). A minimum number of patients was seen in the group above 60 years (2.6%).

This study shows that the mean value of total cholesterol in post-operative day 1 was significantly lesser than the preoperative value. Similarly, the mean values of total cholesterol on postoperative days 3, 7, and 30 were significantly lower than the pre-operative mean values (Figure 2) (Table 1).

In this study, the mean value of triglycerides in post-operative day 30 was found to be lower than the preoperative value, and the difference was statistically significant. However, the mean value of triglycerides was significantly higher on postoperative day 7 compared to preoperative value. There were no significant changes in the mean value of triglyceride on postoperative day 1 and postoperative day 3 in comparison to the preoperative mean value (Table 2).

The mean value of serum HDL cholesterol in post-operative day 1 was significantly higher than the preoperative value. Similarly, the mean values of serum HDL cholesterol on postoperative days 3, 7, and 30 were higher than the pre-operative mean values, and the difference was found to be statistically significant (Figure 3) (Table 3). In this study, the mean value of serum LDL cholesterol in post-operative day 1 was significantly lower than the preoperative value. Similarly, the mean values of serum LDL cholesterol on postoperative days 3, 7, and 30 were lower than the pre-operative mean values, and the difference was found to be statistically significant (Table 4).

This study shows that the mean value of fasting blood sugar level in post-operative day 1 was significantly higher than the preoperative value but within normal limit. Similarly, the mean value of fasting blood sugar level on postoperative day 3, day 7, and day 30 were higher in comparison to the pre-operative mean value, and the difference was found to be statistically significant with a p-value of <0.001 (Table 5).

DISCUSSION:

A total of 113 patients of laparoscopic cholecystectomy who presented with cholelithiasis in the Department of Surgery RIMS, Imphal, during the study period were included in the study, out of which 33 (29.2%) were males, and the remaining 80 (70.8%) were females. Most studies reported female dominance among their study population, which aligns with this study's findings. It may be due to sex hormones and pregnancy-related as the number of pregnancies was related to high rates of gallstone disease in women. Similarly, the sex hormone estrogen increases biliary cholesterol secretion, causing cholesterol supersaturation in bile. Thus, hormone replacement therapy in postmenopausal women has been described to be associated with an increased risk for gallstone disease.

Among the study population, the mean value of total cholesterol during the preoperative period was higher than the normal range. However, there was a significant reduction in the mean value of total cholesterol postoperatively. This high cholesterol level among cholelithiasis patients before cholecystectomy may be because cholelithiasis patients have an abnormal secretory mechanism for bile acids and phospholipids.[12] Another reason may be due to the concomitant metabolic syndrome that usually accompanies cholelithiasis.[13] Thereafter, cholecystectomy significant reduction in the bile acids pool may occur due to rapid cycling around the enterohepatic circulation (EHC)/hour, leading to a significant reduction in the total serum cholesterol as TC is the precursor for the bile acids, so this reduction in the bile acids pool leads to a significant reduction in the TC after cholecystectomy.[14]

The mean value of triglycerides was comparable to the preoperative value on postoperative days 1 and 3. However, the mean triglyceride was higher on postoperative day 7 than the preoperative value. However, on postoperative day 30, it was found to be less than the preoperative value, and the reduction was statistically significant. This increased triglycerides at 1 week post-op period may be due to an increase in catabolic phase and lipolysis that occurs due to the release of adrenaline and noradrenaline during and after surgical trauma that leads to a rise of plasma glycerol and so triglycerides.[2] Further lipolysis rate is also accelerated by general anesthesia due to increased catecholamine production and perioperative glucose infusions.[15]

This study showed a gradual increase in the mean value of serum HDL cholesterol after one month compared with the preoperative value. Previous decrease in serum HDL cholesterol may be due to abnormal secretory mechanisms for the bile acids and phospholipids due to gallstone disease.[12] This increase in HDL cholesterol may be due to an improved health system after cholecystectomy. In this study, the mean values of serum LDL cholesterol and VLDL cholesterol decrease significantly after cholecystectomy. This significant reduction in LDL cholesterol may be due to an increase in bile acids and phospholipids secretion rate after cholecystectomy and upregulation of LDL Apo B receptors, leading to increased LDL entrance into hepatocytes.[14]

In this study, the mean value of fasting blood sugar level in post-operative day 1 was significantly higher than the preoperative value. Similarly, the mean value of fasting blood sugar levels on postoperative day 3, day 7, and day 30 were significantly higher in comparison to the pre-operative mean value. This can be because, after the operation, there is an increase in the catabolic phase, leading to an increase in serum adrenaline and noradrenaline.

CONCLUSION:

Females were predominantly affected by gallstone disease. From the study, it can be concluded that after cholecystectomy, there is a decrease in serum total lipids, serum cholesterol, serum LDL cholesterol, and serum triglycerides, alongside an increase in serum HDL cholesterol. The significant increase in bile acids and phospholipid secretion rates post-cholecystectomy can explain these results. This change can lead to improved bile composition and a notable reduction in the bile acid pool due to rapid cycling around the enterohepatic circulation, significantly reducing total serum cholesterol. This is because total cholesterol serves as a precursor to bile acids, so a reduction in the bile acid pool results in a marked decrease in total cholesterol levels following cholecystectomy.

However, due to the short follow-up period in the study, the long-term effects of these changes on lipid profiles in these patients could not be determined. Therefore, further studies with extended follow-up periods are required to assess the long-term impact.

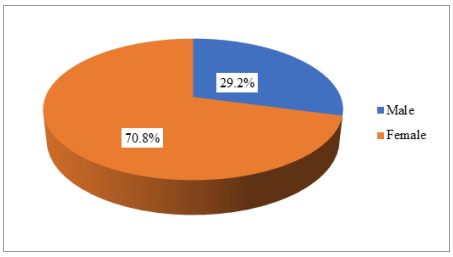

Figure 1. Distribution of patients by gender (N=113)

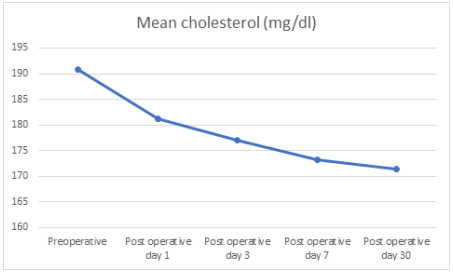

Figure 2. The mean difference in preoperative and postoperative total cholesterol (N=113)

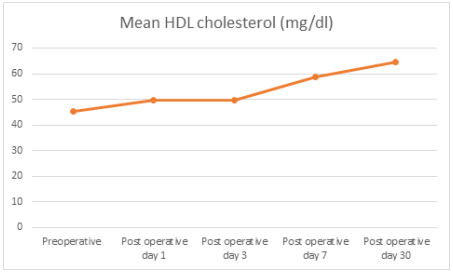

Figure 3. The mean difference in preoperative and post-operative HDL cholesterol (N=113)

Table 1. The mean difference in preoperative and postoperative total cholesterol (N=113)

Sl.no.	Total cholesterol	Mean (mg/dl)	Standard deviation	P value
1.	Preoperative	190.87	39.331	-
2.	Postoperative day 1	181.20	38.392	<0.001
3.	Postoperative day 3	176.97	32.117	<0.001
4.	Postoperative day 7	173.27	31.574	<0.001
5.	Postoperative day 30	171.42	30.020	<0.001

Table 2. The mean difference in preoperative and post-operative triglycerides (N=113)

Sl.no.	Serum triglycerides	Mean (mg/dl)	Standard deviation	P value
1.	Preoperative	188.17	123.42	-
2.	Postoperative day 1	187.17	112.19	0.678
3.	Postoperative day 3	191.63	103.40	0.418
4.	Postoperative day 7	197.55	103.21	0.031
5.	Postoperative day 30	159.39	97.07	<0.001

Table 3. The mean difference in preoperative and post-operative HDL cholesterol (N=113)

Sl.no.	HDL cholesterol	Mean (mg/dl)	Standard deviation	P value
1.	Preoperative	45.30	15.74	-
2.	Postoperative day 1	49.50	15.91	<0.001
3.	Postoperative day 3	49.81	14.36	<0.001
4.	Postoperative day 7	58.84	15.79	<0.001
5.	Postoperative day 30	64.65	16.81	<0.001

Table 4. The mean difference in preoperative and post-operative LDL cholesterol (N=113)

Sl.no.	LDL cholesterol	Mean (mg/dl)	Standard deviation	P value
1.	Preoperative	131.59	34.72	-
2.	Postoperative day 1	121.88	31.83	<0.001
3.	Postoperative day 3	119.81	31.02	<0.001
4.	Postoperative day 7	109.91	27.14	<0.001
5.	Postoperative day 30	98.58	24.39	<0.001

Table 5. The mean difference in preoperative and post-operative fasting blood sugar levels (N=113)

Sl.no.	Fasting blood sugar level	Mean (mg/dl)	Standard deviation	P value
1.	Preoperative	70.65	14.71	-
2.	Postoperative day 1	86.19	16.34	<0.001
3.	Postoperative day 3	82.54	17.01	<0.001
4.	Postoperative day 7	91.78	13.55	<0.001
5.	Postoperative day 30	98.97	12.16	<0.001

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