Comparative Analysis of Serum Lipid Profile before and after Cholecystectomy

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Abstract

Background:

Gallstones are common in the Western world with an incidence of 1.5 per 100 persons per year. Based on facts and evidence, more than 50% of patients with gallstones have some form of lipid disorder. Gallstones are a major health problem because of their silent manifestation and unclear pathogenesis. Cholecystectomy causes redistribution of bile acid pool in the entero-hepatic circulation and increases the frequency of cycling, causing reduction in pool size, thus exerting an effect on lipid profile by decreasing total cholesterol and LDL cholesterol levels.

Aim:

The aim of the present study is to evaluate the lipid profile of patients with gallstones pre- and post-operative cholecystectomy.

Materials and Methods:

This prospective observational study was conducted on 50 patients with gallstones and 30 healthy volunteers for comparison of lipid levels. Cholecystectomy was conducted on patients with gallstones and pre- and post-operative lipid profile levels were compared.

Results:

The total serum lipid profile showed a significant decrease after one month of surgery, while low-density lipoprotein levels and very low-density lipoprotein were not statistically changed. Majority of patients had mixed type of gallstones.

Conclusion:

Cholecystectomy can significantly improve lipid profile levels in patients with gallstones.

Keywords:

Cholecystectomy, serum lipid profile, pathogenesis, cholesterol.

Introduction

Gallstone is commonly observed throughout the world, with an approximately 1.5 per 100 people each year[1]. Women are more common victims of gallstone disease as compared to men[2]. Patients with symptomatic gallstone disease are normally treated via cholecystectomy[3]. Gallstones are basically classified into three main types: cholesterol, pigment, and mixed gallstones.

The process of gallstone formation is complex. Major factors that govern stone formation are: super saturation of bile secreted, concentration of bile inside the gall bladder, crystal nucleation, and abnormal gall bladder emptying[4].

Females are 2–3 times more prone to gallstones than males, mainly due to sex steroids and pregnancy increasing the risk. Oestrogen/oral contraceptives can increase secretion of cholesterol and decrease bile acids, rendering to super saturation of bile and increased lithogenicity[5]. Cholesterol super saturation of bile is most significant factor[6]. Cholesterol is insoluble in water, it is secreted from the canalicular membrane in unilamellar phospholipid vesicles. Cholesterol solubility in bile requires sufficient bile salts and phospholipids. The secretion of cholesterol supersaturated lithogenic bile, bile acid pool concentration, type of phospholipids favouring cholesterol precipitation, gall bladder dysmotility aiding aggregation of cholesterol crystals, delayed large bowel transit time favoring reabsorption of deoxycholic acid, and ideal resection depleting acid pool have all been implicated in gallstone formation[7]. Based on evidence, more than 50% of patients with gallstones have some sort of lipid disorder[8].

Hyperlipidaemia Section

Hyperlipidaemia is generally characterized by high serum levels of total cholesterol, triglycerides, low-density lipoprotein (LDL), and low levels of high-density lipoprotein (HDL). Gallstone association has been most consistently found with high levels of triglycerides and low HDL, whereas it is inconsistent with LDL and total cholesterol level[9]. There is also a strong relation between deranged lipid profile and increased risk of coronary artery disease and stroke[10].

Hypothesis states that after cholecystectomy, a reduced level of bile acid pool size coupled with increased entero-hepatic circulation frequency tends to lower lipid levels by causing a reduction in total cholesterol as well as LDL cholesterol level as well[11].

Current data suggest that a 40 mg/dl decrease in LDL level can translate to a 10% decrease in all-cause mortality, 24% reduction in major coronary events, and 15% in stroke[12]. Since the relationship between cholecystectomy and serum lipid profile has not been established yet, this study investigates the serum lipid profile of patients up to one month post-cholecystectomy.

Aim:

The aim of the present study was to evaluate the lipid profile of patients with gallstones pre and post-operatively and to establish the effect of cholecystectomy on lipid profile one month post surgery, along with evaluating correlation between the type of stones and serum lipid profile.

Materials and Methods

The study was carried out in the Department of Surgery and Department of Biochemistry in a tertiary care center attached to Rama Medical College Hospital and Research, Hapur, prospectively from 2024 to 2025.

Patients with gallstone disease admitted to the Department of General Surgery underwent cholecystectomy. Patients were evaluated and their complete history was recorded after taking detailed biodata.

Diagnosis was based on clinical findings, supported by ultrasonography and confirmed pre operatively.

Patients with conditions affecting lipid levels such as diabetes mellitus, renal failure, hypothyroidism, and nephrotic syndrome were excluded from the study.

Gallstones were collected after cholecystectomy and divided into three categories based on shape, size, and texture:

Pale yellow/whitish → cholesterol calculi

Black/brown → pigment calculi

Brownish-yellow or greenish with laminated features → mixed calculi

Various physical parameters such as number, shape, size, texture, and cross-section were noted. The gallstones were analyzed for physical and chemical nature, and correlation was done between type of stone and serum lipid profile both pre-operatively and post-operatively.

Results

Group A consisted of 32 females and 18 males with female to male ratio of 1.7:1, while Group B had 18 females and 12 males with ratio of 1.5:1. The average body mass index of patients in both the groups was 27.45 and 25.66 kg/m² respectively.

The biochemical analysis of stones revealed that maximum stones were cholesterol stones (36, 72%) followed by mixed (8, 16%) and pigment stones (6, 12%). (82% 41) of patients presented with multiple stone, while in only 18% solitary stones were present.

The mean of serum lipids of controls and in patients taken before surgery is shown in Table 1. The mean levels of TC, TGs, and VLDL-C were observed to be significantly elevated in patients with cholelithiasis as compared to controls. The mean levels of LDL-C were although higher in patients, but the rise was not statistically significant. Similarly, the mean levels of HDL-C were lower in patients, but the decrease was not statistically significant.

Table 1.
Serum lipid profile in Groups A and B

Parameters	Group A (preoperative)	Group B (controls)	P
TC (mg%)	162.97 ± 32.88	142 ± 22.65	<0.01
TGs (mg%)	196.66 ± 92.82	142.88 ± 69.54	<0.001
HDL-C (mg%)	43.27 ± 8.85	46.55 ± 10.32	0.20
LDL-C (mg%)	107.93 ± 20.43	104.32 ± 32.28	0.41
VLDL (mg%)	39.40 ± 67.87	28.31 ± 56.77	<0.001

All values in mean ± SD. TC: Total cholesterol; HDL-C: High-density lipoprotein cholesterol; LDL-C: Low-density lipoprotein cholesterol; TGs: Triglycerides; VLDL: Very low-density lipoprotein; SD: Standard deviation

The mean levels of serum lipid levels of Group A preoperative, postoperative (1 week and 1 month after surgery) are shown in Table 2. The decrease in mean levels of serum cholesterol was significant after 1 week of surgery and highly significant after 1 month of surgery. There was a significant increase in serum TGs after 1 week of surgery, but after 1 month they reverted back to normal, and this decrease was highly significant. The serum HDL-C slightly decreased after 1 week of surgery, but it significantly increased after 1 month of surgery, however, no significant difference was observed in LDL-C and VLDL-C after 1 week

and 1 month of surgery.

Table 2.
Serum lipid profile in Group A preoperative, 1 week and 1 month postoperative

Parameters	Preoperative	1 week postoperative	P	1 month postoperative	P*
TC (mg%)	162.97 ± 32.88	150.92 ± 28.31	<0.01	123.63 ± 35.32	<0.001
TGs (mg%)	196.66 ± 92.82	213.81 ± 69.98	<0.01	179.72 ± 52.27	<0.001
HDL-C (mg%)	43.27 ± 8.85	40.87 ± 3.62	0.063	48.24 ± 4.93	<0.001
LDL-C (mg%)	107.93 ± 20.43	102.32 ± 8.88	0.060	105.71 ± 33.33	0.023
VLDL (mg%)	39.40 ± 67.87	40.7± 25.28	0.231	34.51 ± 28.28	0.33

*Compared to preoperative; all values in mean ± SD. TC: Total cholesterol; HDL-C: High-density lipoprotein cholesterol; LDL-C: Low-density lipoprotein cholesterol; TGs: Triglycerides; VLDL: Very low-density lipoprotein; SD: Standard deviation

Discussion

Around half of the patients of cholelithiasis have abnormal lipid profile. This increases the incidence of coronary artery disease (CAD) and stroke. Recent studies have shown that hypertriglyceridemia, hypercholesterolemia, and low level of HDL-C are commonly associated with cholelithiasis. It is a well-known fact that this association can further lead to CAD and stroke. In the present study, the mean levels of TC, TGs, and VLDL-C were significantly elevated in patients with cholelithiasis as compared to controls, while there was insignificant difference for LDL-C and HDL-C levels.

In the present study, there was a significant decrease in levels of TC after one week of surgery and after 1 month of surgery. Similarly, TGs levels after 1 month of surgery were significantly decreased. Other studies have shown similar results. In the present study, the serum HDL-C slightly decreased after 1 week of surgery, but it significantly increased after 1 month of surgery. This effect is in contrast to the study conducted by Malik et al. who reported no change on HDL-C levels after 6 months of surgery.

From the study, it can be concluded that cholecystectomy leads to normalization of lipid levels and thus can be helpful in blocking the subsequent development of CAD and stroke.

Limitations of the study

Patients were on medications postoperatively, and effect of medications was not checked. This can be a confounding as well as a limitation in the study. At the same time, no distinction was made between open and laparoscopic cholecystectomy, again a limitation of the study.

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