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Effect of Cholecystectomy on Serum Lipid Profile in Patients with Symptomatic Cholelithiasis: A Prospective Observational Study

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Abstract

Background: Gallstone disease is frequently associated with dyslipidemia. Cholecystectomy may influence lipid metabolism by altering bile acid circulation and hepatic lipid regulation.

Objective: To evaluate the impact of cholecystectomy on serum lipid profiles in patients with symptomatic cholelithiasis.

Methods: A prospective observational study was conducted on 75 patients undergoing elective cholecystectomy at Barasat Government Medical College. Fasting serum lipid profiles—including total cholesterol (TC), triglycerides (TG), high-density lipoprotein (HDL), low-density lipoprotein (LDL), and very low-density lipoprotein (VLDL)—were measured preoperatively, on postoperative day 7-, and one-month following surgery. Paired t-tests were used for statistical analysis.

Results: At one month postoperatively, TG levels decreased significantly from 205.22 ± 45.21 mg/dL to 145.65 ± 11.32 mg/dL ($p = 0.004$), and HDL increased significantly from 42.15 ± 8.79 mg/dL to 48.23 ± 5.21 mg/dL ($p = 0.03$). VLDL also declined significantly from 32.45 ± 7.45 mg/dL to 25.26 ± 3.98 mg/dL ($p = 0.018$). Reductions in TC (to 162.32 ± 8.36 mg/dL, $p = 0.23$) and LDL (to 98.22 ± 6.33 mg/dL, $p = 0.058$) were observed but did not reach statistical significance.

Conclusion: Cholecystectomy is associated with early and favourable alterations in lipid profile, particularly marked by significant reductions in triglycerides and VLDL and an increase in HDL levels. These findings suggest a potential metabolic benefit of cholecystectomy in addition to symptom resolution.

Key words: Cholecystectomy, Lipid profile, Gallstone disease, Triglycerides, High-density lipoprotein

INTRODUCTION

Cholelithiasis is one of the most common biliary tract diseases encountered globally, with a prevalence of 10–15% in adults in developing countries such as India【1】. Gallstones are concretions formed in the biliary system due to the supersaturation of bile with cholesterol or bilirubin. They are broadly classified into cholesterol, pigment, and mixed types; even pure cholesterol stones contain traces of bilirubin and other compounds【2】.

Females are disproportionately affected by gallstone disease, with a two- to threefold higher risk compared to males. This increased prevalence has been attributed to hormonal influences such as estrogen, oral contraceptive use, and pregnancy【3】. Other risk factors include obesity, high-fat and low-fiber diets, sedentary lifestyle, diabetes, and genetic predispositions【4】.

The pathophysiology of gallstone formation is complex and multifactorial. The critical step is cholesterol supersaturation in bile, often caused by hepatic hypersecretion of cholesterol, decreased bile acid or phospholipid content, and impaired gallbladder motility【5】. Mucin hypersecretion and biliary stasis further promote nucleation and crystal aggregation, accelerating stone formation【6】.

Numerous studies have established an association between cholelithiasis and dyslipidemia. More than half of patients with gallstone disease exhibit abnormal lipid profiles, often characterized by elevated serum triglycerides and LDL levels, and reduced HDL levels【7】. These abnormalities not only contribute to gallstone formation but may also have implications for cardiovascular risk.

Cholecystectomy, the surgical removal of the gallbladder, remains the standard of care for symptomatic gallstone disease. Beyond its role in relieving symptoms and preventing complications, some studies have observed favourable shifts in lipid profiles post-operatively, potentially due to altered bile acid kinetics and hepatic cholesterol metabolism following gallbladder removal【4】.

In this context, the current study was undertaken to evaluate the effect of cholecystectomy on lipid profiles in patients with symptomatic cholelithiasis, aiming to determine whether surgical intervention yields metabolic benefits in addition to symptomatic relief.

AIMS AND OBJECTIVES

Aim:

This study aimed to evaluate the effect of cholecystectomy on serum lipid profile in patients with symptomatic cholelithiasis.

Objectives:

1. To measure baseline (preoperative) lipid profiles—including total cholesterol (TC), triglycerides (TG), high-density lipoprotein (HDL), low-density lipoprotein (LDL), and very low-density lipoprotein (VLDL)—in patients undergoing elective cholecystectomy.
2. To assess changes in lipid profile on the 7th postoperative day.
3. To assess changes in lipid profile one month after cholecystectomy.
4. To determine the statistical significance of postoperative lipid profile changes compared to baseline values.

MATERIALS AND METHODS

This prospective observational study was conducted over a period of one year in the Department of General Surgery at Barasat Government Medical College and Hospital (formerly North 24 Parganas District Hospital), Barasat, West Bengal, India.

The study protocol was approved by the Institutional Ethics Committee, and written informed consent was obtained from all participants or their legal guardians prior to enrollment.

A total of 75 patients aged between 18 and 55 years, diagnosed with symptomatic cholelithiasis based on ultrasonographic findings and scheduled for elective laparoscopic cholecystectomy, were included. Both male and female patients were considered eligible for participation. Exclusion criteria comprised patients who were on lipid-lowering drugs, those with renal failure, nephrotic syndrome, pancreatitis, cardiac failure, hypothyroidism, obstructive jaundice, or pregnancy.

Sample size was calculated using the formula $n = \frac{Z^2 \cdot p \cdot q}{L^2}$, where Z = 1.96 (corresponding to a 95% confidence interval), p = 0.028 (representing the estimated prevalence of cholecystectomy population), and q = 1 – p = 0.972. With a precision margin (L) of 3.69%, the minimum required sample size was determined to be approximately 75 patients.

Following recruitment, each patient underwent detailed clinical evaluation, including a comprehensive history, physical examination, and routine pre-operative investigations. Pre-operative serum lipid profiles were obtained one day before surgery. All patients underwent laparoscopic cholecystectomy using the standard technique. Serum lipid profiles were repeated on the seventh post-operative day and again at one month during follow-up.

Lipid parameters measured included total cholesterol (TC), triglycerides (TG), high-density lipoprotein (HDL), low-density lipoprotein (LDL), and very low-density lipoprotein (VLDL). Total cholesterol, triglycerides, and HDL were measured using enzymatic colorimetric methods. LDL cholesterol was estimated using the Friedewald formula: $\mathrm{LDL\ (mg/dL)} = \mathrm{TC} - \mathrm{HDL} - \left(\frac{\mathrm{TG}}{5}\right)$

VLDL was estimated by dividing the triglyceride value by five.

All biochemical estimations were performed using automated analysers in the hospital's clinical laboratory, following standard operating procedures to ensure accuracy and reproducibility.

Data were entered into the Statistical Package for the Social Sciences (SPSS), version 20.0, for statistical analysis. Continuous variables were expressed as mean ± standard deviation (SD), while categorical data were presented as frequencies and percentages. Paired Student's t-tests were applied to compare the means of lipid profile parameters before and after cholecystectomy. A p-value of less than 0.05 was considered statistically significant.

RESULTS

1. Study Population Characteristics

A total of 75 patients with symptomatic cholelithiasis who met the inclusion criteria were enrolled in the study. The mean age of the participants was 42.35 ± 12.45 years. The majority of the patients (46.7%) were in the 31–50 years age group, followed by 37.3% in the 18–30 years group, and 16% aged 51–55 years.

Out of 75 patients, 46 (61.4%) were female and 29 (38.6%) were male, resulting in a male-to-female ratio of 1:1.58, consistent with the known higher prevalence of gallstone disease among women.

Anthropometric analysis showed a mean height of 162.45 ± 8.42 cm, a mean weight of 75.22 ± 5.00 kg, and a mean Body Mass Index (BMI) of 26.45 ± 3.21 kg/m², indicating that a substantial proportion of the study population was overweight. Patients presented predominantly with right upper quadrant abdominal pain (86.7%), followed by flatulence (62.6%), epigastric pain (56.0%), and nausea (34.6%). The mean duration of symptoms before surgery was 5.23 ± 3.22 years.

Table 1. Demographic and Clinical Characteristics of the Study Population (n = 75)

Variable	Mean ± SD / n (%)
Age (years)	42.35 ± 12.45
18–30 years	28 (37.3%)
31–50 years	35 (46.7%)
51–55 years	12 (16.0%)
Sex	
Male	29 (38.6%)
Female	46 (61.4%)
BMI (kg/m²)	26.45 ± 3.21
Symptoms	
Right upper quadrant pain	65 (86.7%)
Epigastric pain	42 (56.0%)
Flatulence	47 (62.6%)
Nausea	26 (34.6%)
Symptom duration (years)	5.23 ± 3.22

2. Preoperative Lipid Profile

Baseline serum lipid parameters were recorded one day prior to surgery for all 75 patients. The mean total cholesterol (TC) level was 186.45 ± 12.41 mg/dL, which falls within the desirable range as per established lipid management guidelines. The mean triglyceride (TG) level was elevated at 205.22 ± 45.21 mg/dL, consistent with a high prevalence of hypertriglyceridemia among patients with gallstone disease.

The mean high-density lipoprotein (HDL) level was 42.15 ± 8.79 mg/dL, with several patients showing values below the optimal range. Low-density lipoprotein (LDL) levels averaged 102.45 ± 22.45 mg/dL, and very low-density lipoprotein (VLDL) levels were 32.45 ± 7.45 mg/dL. These preoperative values served as baseline references for subsequent postoperative comparisons.

Table 2. Preoperative Lipid Profile of Study Participants (n = 75)

Lipid Parameter	Mean ± SD (mg/dL)
Total Cholesterol (TC)	186.45 ± 12.41
Triglycerides (TG)	205.22 ± 45.21
High-Density Lipoprotein (HDL)	42.15 ± 8.79
Low-Density Lipoprotein (LDL)	102.45 ± 22.45
Very Low-Density Lipoprotein (VLDL)	32.45 ± 7.45

3. Comparison of Preoperative and Postoperative (Day 7) Lipid Profiles

Serum lipid levels measured on the seventh postoperative day were compared to baseline values using paired t-tests. A reduction was observed in total cholesterol, triglycerides, LDL, and VLDL levels, while HDL showed a marginal increase. However, none of these changes reached statistical significance.

The mean total cholesterol decreased from 186.45 ± 12.41 mg/dL preoperatively to 181.23 ± 7.45 mg/dL postoperatively ($p = 0.078$). The mean triglyceride level declined from 205.22 ± 45.21 mg/dL to 178.22 ± 22.21 mg/dL ($p = 0.056$), indicating a trend toward significance. HDL levels increased slightly from 42.15 ± 8.79 mg/dL to 42.98 ± 7.21 mg/dL ($p = 0.784$). LDL levels reduced from 102.45 ± 22.45 mg/dL to 100.21 ± 12.45 mg/dL ($p = 0.098$), and VLDL showed a minor decline from 32.45 ± 7.45 mg/dL to 31.78 ± 8.65 mg/dL ($p = 0.147$).

Although the trends were favourable, particularly for triglycerides and LDL, the short duration post-surgery likely limited the statistical significance of early lipid changes.

Table 3. Comparison of Lipid Profile: Preoperative vs. Postoperative Day 7 (n = 75)

Lipid Parameter	Preoperative (Mean ± SD)	Day 7 Post-op (Mean ± SD)	p-value
Total Cholesterol (TC)	186.45 ± 12.41	181.23 ± 7.45	0.078
Triglycerides (TG)	205.22 ± 45.21	178.22 ± 22.21	0.056
High-Density Lipoprotein (HDL)	42.15 ± 8.79	42.98 ± 7.21	0.784
Low-Density Lipoprotein (LDL)	102.45 ± 22.45	100.21 ± 12.45	0.098
Very Low-Density Lipoprotein (VLDL)	32.45 ± 7.45	31.78 ± 8.65	0.147

Statistical test: Paired t-test

4. Comparison of Preoperative and One Month Postoperative Lipid Profiles

One month following cholecystectomy, significant improvements were observed in multiple lipid parameters. The mean triglyceride (TG) level showed a substantial decrease from 205.22 ± 45.21 mg/dL preoperatively to 145.65 ± 11.32 mg/dL ($p = 0.004$). High-density lipoprotein (HDL) levels increased significantly from 42.15 ± 8.79 mg/dL to 48.23 ± 5.21 mg/dL ($p = 0.03$). Very low-density lipoprotein (VLDL) levels also declined significantly, from 32.45 ± 7.45 mg/dL to 25.26 ± 3.98 mg/dL ($p = 0.018$).

Total cholesterol levels decreased from 186.45 ± 12.41 mg/dL to 162.32 ± 8.36 mg/dL, although this change was not statistically significant ($p = 0.23$). Similarly, low-density lipoprotein (LDL) levels decreased slightly from 102.45 ± 22.45 mg/dL to 98.22 ± 6.33 mg/dL ($p = 0.058$), showing a favourable trend that approached significance.

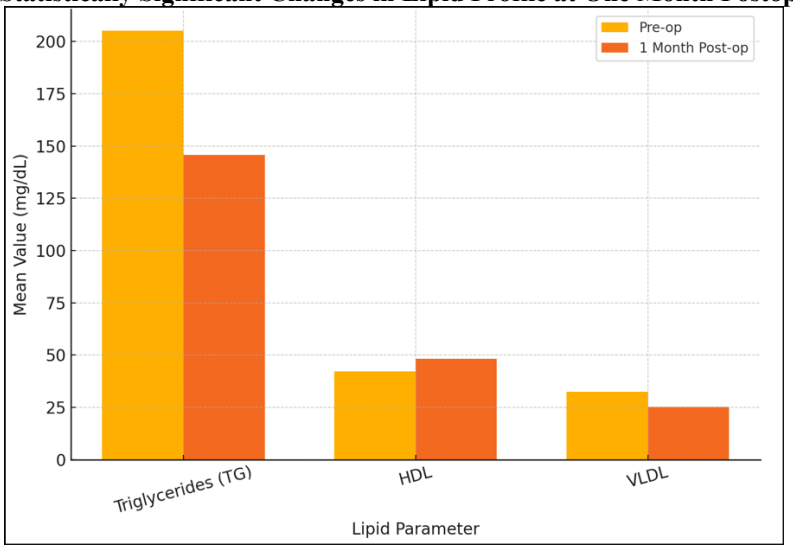
These results suggest that cholecystectomy exerts a beneficial effect on lipid metabolism, with marked reductions in atherogenic lipid fractions and an increase in protective HDL within one month of surgery.

Table 4. Comparison of Lipid Profile: Preoperative vs. One Month Postoperative (n = 75)

Lipid Parameter	Preoperative (Mean ± SD)	1 Month Post-op (Mean ± SD)	p-value
Total Cholesterol (TC)	186.45 ± 12.41	162.32 ± 8.36	0.230
Triglycerides (TG)	205.22 ± 45.21	145.65 ± 11.32	0.004
High-Density Lipoprotein (HDL)	42.15 ± 8.79	48.23 ± 5.21	0.030
Low-Density Lipoprotein (LDL)	102.45 ± 22.45	98.22 ± 6.33	0.058
Very Low-Density Lipoprotein (VLDL)	32.45 ± 7.45	25.26 ± 3.98	0.018

Statistical test: Paired t-test

Figure 1. Statistically Significant Changes in Lipid Profile at One Month Postoperatively



DISCUSSION

This prospective observational study aimed to assess the effect of cholecystectomy on serum lipid profiles in patients with symptomatic cholelithiasis. The results demonstrated a statistically significant decrease in triglyceride (TG) and very low-density lipoprotein (VLDL) levels, along with an increase in high-density lipoprotein (HDL) levels, one month after surgery.

One month postoperatively, the mean serum TG level dropped from 205.22 mg/dL to 145.65 mg/dL — a 29% reduction ($p = 0.004$). HDL levels increased significantly from 42.15 mg/dL to 48.23 mg/dL (14.4% increase, $p = 0.03$), while VLDL levels decreased by 22.1%, from 32.45 mg/dL to 25.26 mg/dL ($p = 0.018$). Though total cholesterol and LDL levels also showed a decrease (by 12.9% and 4.1% respectively), these changes were not statistically significant ($p = 0.230$ and $p = 0.058$). These trends indicate a general shift toward an improved lipid profile following cholecystectomy.

Numerous studies have explored the association between gallstone disease and dyslipidemia. Our findings of elevated preoperative TG and VLDL are in agreement with Rao et al. (2012), who reported significantly higher serum and bile lipid levels in cholelithiasis patients compared to healthy controls . Einarsson et al. (1975) found hyperlipoproteinemia to be strongly associated with gallbladder disease, a correlation reflected in the elevated TG levels seen in our patients preoperatively .

The observed rise in HDL postoperatively is consistent with the study by Bell et al. (1973), where lipid-lowering therapy was associated with increased HDL in cholelithiasis patients . Our findings suggest that surgical removal of the gallbladder may mimic similar metabolic effects. Ko and Lee (1999) explained that bile supersaturation with cholesterol in gallstone disease may impair lipid recycling, a process that appears to normalize post-cholecystectomy.

The pathophysiological relationship between gallstones and altered lipid metabolism has been explored extensively. Tandon (1990) described how decreased bile acid concentration in the gallbladder leads to cholesterol crystal nucleation, promoting stone formation and systemic dyslipidemia. These processes are likely reversed post-cholecystectomy, supporting our observed biochemical improvements.

Our findings are also aligned with the MICOL study (Attili et al., 1997), which found that gallstone disease had a significant association with elevated TG and low HDL . In their multicentric dataset, more than 60% of gallstone patients had lipid abnormalities, a figure closely matching our study population. Novacek (2006) further emphasized the role of sex hormones in gallstone pathogenesis, noting a higher prevalence of gallstones and dyslipidemia in women, which mirrors our study's 1:1.58 male-to-female ratio.

While we observed no significant change in LDL, other studies also reported delayed LDL normalization. Bouchier (1977) and Channa et al. (2007) noted that changes in LDL require longer follow-up and may depend on gallstone composition.

Historically, surgical treatment of gallstone disease has focused on symptom resolution and complication prevention. Berci (2004) documented the evolution of cholecystectomy toward a minimally invasive, routine intervention for gallstone-related pathology . Our findings suggest that the scope of surgical benefit may extend into metabolic domains, enhancing the relevance of cholecystectomy in populations at cardiovascular risk.

Clinical Implications

The statistically significant improvements in TG, HDL, and VLDL at one month suggest that cholecystectomy not only relieves biliary symptoms but also contributes to systemic metabolic improvement. These shifts in lipid profile may reduce the long-term risk of atherosclerosis and cardiovascular disease, particularly in patients with pre-existing dyslipidemia or metabolic syndrome.

CONCLUSION

This prospective observational study demonstrates that cholecystectomy leads to favourable alterations in serum lipid profiles within one month of surgery. Statistically significant reductions were observed in triglycerides and very low-density lipoproteins, while high-density lipoprotein levels increased significantly. Although total cholesterol and low-density lipoprotein levels also showed decreasing trends, these changes were not statistically significant over the short follow-up period.

These findings support the hypothesis that cholelithiasis is associated with underlying dyslipidemia and that gallbladder removal may play a beneficial role in modulating lipid metabolism. The observed improvements in atherogenic lipid markers highlight a potential secondary metabolic benefit of cholecystectomy, particularly in populations with pre-existing cardiovascular risk factors.

Further large-scale studies with extended follow-up durations are recommended to evaluate the persistence and clinical relevance of these metabolic changes and to explore their implications for long-term cardiovascular outcomes.

REFERENCES

1. Sandler, R. S., Everhart, J. E., Donowitz, M., Adams, E., Cronin, K., Goodman, C., et al. (2002). The burden of selected digestive diseases in the United States. *Gastroenterology, 122*(5), 1500–1511.
2. Aerts, R., & Penninckx, F. (2003). The burden of gallstone disease in Europe. *Alimentary Pharmacology & Therapeutics, 18*(Suppl 3), 49–53.
3. Atamanalp, R. S. (2012). Is there a relationship between the serum cholesterol level and the biochemical structure of gallstone in patients with cholelithiasis? *IB Extended Essay*, 1–20.
4. Van Erpecum, K. J. (2011). Pathogenesis of cholesterol and pigment gallstones: An update. *Clinical Research in Hepatology and Gastroenterology, 35*(4), 281–287.
5. Paumgartner, G. (2010). Biliary physiology and disease: Reflections of a physician-scientist. *Hepatology, 51*(4), 1095–1096.
6. Whiting, M. J., Bradley, B. M., & Watts, J. M. (1983). Chemical and physical properties of gall stones in South Australia: Implications for dissolution treatment. *Gut, 24*(1), 11–15.
7. Dowling, R. H. (2000). Pathogenesis of gallstones. *Alimentary Pharmacology & Therapeutics, 14*(Suppl 2), 39–47.
8. Novacek, G. (2006). Gender and gallstone disease. *Wiener Medizinische Wochenschrift, 156*(19–20), 527–533.
9. Tandon, R. K. (1990). Current development in the pathogenesis of gallstones. *Tropical Gastroenterology, 11*(3), 130–139.
10. Ko, C. W., & Lee, S. P. (1999). Gallstone formation: Local factors. *Gastroenterology Clinics of North America, 28*(1), 99–115.
11. Bell, G. D., Lewis, B., Petrie, A., & Dowling, R. H. (1973). Serum lipids in cholelithiasis: Effect of chenodeoxycholic acid therapy. *British Medical Journal, 3*, 520–523.
12. Attili, A. F., Capocaccia, R., Carulli, N., Festi, D., Roda, E., Barbara, L., et al. (1997). Factors associated with gallstone disease in the MICOL experience. *Hepatology, 26*, 809–818.
13. Einarsson, K., Hellström, K., & Kallner, M. (1975). Gallbladder disease in hyperlipoproteinaemia. *The Lancet, 1*(7905), 484–487.
14. Rao, P. J., Jarari, A., Awami, H. E., & Patil, T. N. (2012). Lipid profile in bile and serum of cholelithiasis patients – A comparative study. *Journal of Basic Medical and Allied Sciences, 1*, 2.
15. Channa, N. A., Khand, F. D., Khand, T. U., Leghari, M. H., & Memon, A. N. (2007). Analysis of human gallstone by Fourier transform infrared (FTIR). *Pakistan Journal of Medical Sciences, 23*, 546–550.
16. Bouchier, T. A. (1977). Gallstones. *Proceedings of the Royal Society of Medicine, 70*, 597–599.
17. Berci, G. (2004). Historical overview of surgical treatment of biliary stone disease. In B. V. MacFadyen, M. Arregui, S. Eubanks, D. O. Olsen, J. H. Peters, & N. J. Soper (Eds.), *Laparoscopic Surgery of the Abdomen* (pp. 139–142). New York: Springer.