Original Article

# The Effect of Laparoscopic Cholecystectomy on Lipid Profile

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## Abstract

**Background:** Gallstone disease (GSD) is one of the most common surgical gastrointestinal diseases. Cholesterol is one of the constituents of gallstones. Hyperlipidemia and GSD are often linked to cholesterol in pathophysiology, and cholecystectomy is associated with hepatobiliary circulation affecting fat absorption. The aim of the study is to assess the lipid profile (LP) changes after laparoscopic cholecystectomy (LC). **Methods:** Prospective cohort study that included 200 patients with documented GSD and baseline measurement of LP, followed by LC for half of them, and two follow-up measurements of LP after 2 weeks and 1 month. Comparison of the LP between the two groups to estimate the difference that occur due to LC, after that, comparison of the two follow-up measurements with baseline to estimate the effect of these changes with time. **Results:** Total serum cholesterol (TC) and triglyceride level (TG) were significantly lower from control 1 month after surgery; on pairwise analysis, TG level was lower than baseline on both 2-week and 1-month follow-up measurements. High-density lipoprotein (HDL) was higher than the control after 1 month, on pairwise analysis at 2 weeks, no difference from baseline was found, and a significant difference was found after 1 month. Both low-density lipoprotein (LDL) and very LDL (VLDL) were not different from the control. **Conclusion:** LC is associated with a reduction of the serum level of both TC and TG and an increase serum level of HDL after 1 month of follow-up.

**Keywords:** Cholesterol, gallstone, hyperlipidemia, laparoscopic cholecystectomy, triglyceride

## Introduction

Gallstone disease (GSD) is one of the most common surgical gastrointestinal diseases.[1] Although the exact incidence is unknown as the majority of cases were asymptomatic, the proposed incidence may reach up to 1.39 for every 100 person in the year.[2] Laparoscopic cholecystectomy (LC), the standard management of symptomatic gallstones, is one of commonly performed elective surgeries.[3] Biliary cholic or acute cholecystitis is the most common fates of GSD.[4] It is worthy to note that obese patients had a higher rate of having gallstones,[5] and cholesterol is one of the components of gallstones.[6] The mechanism that gallstones formed is multifactorial, the supersaturation of the cholesterol in bile is the most determinantal step. As cholesterol solubility in bile is dependent on the concentration of other components of bile (namely bile salt and phospholipids), at low concentrations of these components, cholesterol tends to be insoluble, forming a lithogenic nucleus for the gallstone.[7] Hyperlipidemia is a well-known risk factor for many cardiovascular morbidities.[8] The association of GSD with obesity raised the suspicion of pathological processes that link GSD and abnormal lipid profile (LP). Many studies had confirmed this concern.[9,10] The opposite (GSD could induce dyslipidemia?) had been investigated and results had been linked to a common enemy, insulin resistance, making the gallbladder a metabolic regulatory organ,[11] that had its own rhythm in bile secretion,[12] that could be affected by LC.[13] These relations caught our attention to investigate the effect of cholecystectomy in the alteration of LP.

The aim of the study is to assess the LP changes after LC.

## Methods

A prospective cohort study was conducted at one of the major surgical hospitals over a period of 1 year (April 1, 2021, to April 1, 2022), the study included 200 participants of both sexes presented with symptomatic GSD that was

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diagnosed by abdominal ultrasound. All participants were candidates for LC. Cases with common bile duct stones, acute cholecystitis, familial hyperlipidemia, medical comorbidity, obese patients (body mass index >30 kg/m$^2$), hematological diseases, patients on lipid-lowering agents, and pregnant patients were excluded from the study. The study group was divided into two groups each included 100 cases, the first group (Group A) were undergone LC, and the other group (Group B) were 100 cases that had an appointment for surgery for more than 1 month. All cases were interviewed, and detailed history and physical examination were done a day before surgery. All cases are advised to have a regular diet without modification.

For Group A, participants were fasting for 12 h then two milliliters of venous blood drown 1 day before surgery, 2 weeks, and 1 month after surgery. For Group B also, fasting samples were collected at starting day, after 2 weeks, and 1 month.

The same hospital laboratory was used with reporting the result of TC, TG, HDL, LDL, and VLDL.

Written consent was obtained from all participants, research proposal was approved by the scientific committee of the same hospital.

Statistical analysis: data were introduced to Microsoft Excel 365 and the statistical analysis was done using SPSS statistical analysis software (IBM company, Illinois, United States). Data were presented in the form of mean and standard deviation (±), counts, and percentages.

Comparison between the two groups to estimate the difference those undergone LC and those who did not using unpaired student *t*-test. After that comparison of LP parameters before surgery, 2 weeks, and 1 month after surgery using paired student *t*-test to estimate the effect of LC on LP. $P < 0.05$ considered significant.

## Results

Two hundred cases were included in the study. The case group included 93 females and 7 males, whereas the control group included 91 females and 9 males. The mean TC and TG were not different in both baseline and after 2-week readings, but after 1 month, both TC and TG were significantly lower in the case group than the control group.

Mean HDL was higher after both 2 weeks and 1 month in the case group than in the control group. Both LDL and VLDL were not different significantly from the control. Table 1 shows the distribution of gender and LP parameters between case and control groups.

On comparison of the lipid profile of patients undergone surgery, we found that significant reduction in mean TC, TG, and LDL after 1 month of surgery, and a significant increment of mean HDL after 1 month of the surgery, as shown in Table 2.

**Table 1: Comparison between case and control groups**

| Variables | Case | Control | *P* |
|---|---|---|---|
| Gender | | | |
| Male (%) | 7 (7) | 9 (9) | 0.602 |
| Female (%) | 93 (93) | 91 (91) | |
| TC (mg/dL) | | | |
| Baseline±SD | 201.18±42.62 | 201.96±45.62 | 0.901 |
| After 2 weeks±SD | 190.01±34.62 | 200.58±40.96 | 0.050 |
| After 1 month±SD | 158.3±30.28 | 203.41±42.36 | <0.001 |
| TG (mg/dL) | | | |
| Baseline±SD | 112.95±36.55 | 107.18±42.58 | 0.305 |
| After 2 weeks±SD | 105.54±36.07 | 99.5±39.29 | 0.259 |
| After 1 month±SD | 88.73±38.24 | 110.32±40.96 | <0.001 |
| HDL (mg/dL) | | | |
| Baseline±SD | 98.95±23.84 | 100.35±26.33 | 0.694 |
| After 2 weeks±SD | 110.21±25.22 | 97.32±25.93 | <0.001 |
| After 1 month±SD | 120.83±30.85 | 100.04±24.76 | <0.001 |
| LDL (mg/dL) | | | |
| Baseline±SD | 80.62±49.88 | 82.63±49.67 | 0.775 |
| After 2 weeks±SD | 74.55±47.08 | 80.45±47.64 | 0.379 |
| After 1 month±SD | 43.27±35.22 | 52.33±42.96 | 0.104 |
| VLDL (mg/dL) | | | |
| Baseline±SD | 22.59±7.31 | 21.44±8.52 | 0.305 |
| After 2 weeks±SD | 21.58±7.3 | 19.9±7.86 | 0.118 |
| After 1 month±SD | 19.88±7.17 | 21.77±8.15 | 0.083 |

SD: Standard deviation, TC: Total serum cholesterol, TG: Triglyceride level, HDL: High-density lipoprotein, LDL: Low-density lipoprotein, VLDL: Very LDL

## Discussion

Cholelithiasis and hyperlipidemia are both common disorders with tangled pathophysiology that had cholesterol as a common link. The increased dietary intake of fat had increased the risk of both disorders.[14] In this study, we aimed to investigate the chronological changes in the level of LP parameters after LC.

The study included female participants more than males, this finding may be attributed to the selection technique of only cases of gallstone as GSD is more prevalent in females as found by previous studies.[14]

The LPs of both groups were not different at the starting of the study, this eliminates sampling bias, thus increase the internal validity of the study.

Total cholesterol was found to decrease over time in cases of cholecystectomies, and after 1 month, this difference between the groups became significant. On comparison of the level of TC of the same group over time, we found the decrement was not significant after first 2 weeks but get significant after the 1$^{st}$ month. Sergeev *et al*.[15] also found a significant decrease in the level of TC after cholecystectomy. Gill and Gupta[16] found a significant decline of TC levels after 1 month and Malik *et al*.[17] found a significant reduction also for the first 6 months. Osman *et al*.[18] also stated the reduction in TC started from the 5$^{th}$ day till the 6$^{th}$ month.

Triglycerides level was lower in those undergone LC than in control after 1 month, on running pairwise statistical

**Table 2: Comparison of lipid profile before and after surgery of case group**

| Variable | Baseline (mean±SD) | After 2 weeks (mean±SD) | *P*: Baseline versus 2 weeks | After 1 month (mean±SD) | *P*: Baseline versus 1 month |
|---|---|---|---|---|---|
| TC | 201.18±42.62 | 190.01±34.62 | 0.110 | 158.3±30.28 | <0.001 |
| TG | 112.95±36.55 | 105.54±36.07 | 0.049 | 88.73±38.24 | 0.005 |
| HDL | 98.95±23.84 | 110.21±25.22 | 0.129 | 120.83±30.85 | <0.001 |
| LDL | 80.62±49.88 | 74.55±47.08 | 0.370 | 43.27±35.22 | <0.001 |
| VLDL | 22.59±7.31 | 21.58±7.3 | 0.074 | 19.88±7.17 | 0.130 |

SD: Standard deviation, TC: Total serum cholesterol, TG: Triglyceride level, HDL: High-density lipoprotein, LDL: Low-density lipoprotein, VLDL: Very LDL

analysis for comparison of the effect of LC on the same population, we found that significant decline in the level of TG after both 2 weeks and month. Similar results were found by Sergeev *et al*.,[15] Gill and Gupta,[16] Malik *et al*.,[17] and Osman *et al*.[18]

The reduction of both TC and TG may attributed to the fact that removal of the gallbladder is associated with the secretion of more diluted bile leading to increased fecal loss (as stated by Sergeev *et al*.[15]) of bile which may reduce enterohepatic circulation leading to the altered fat absorption.

The mean HDL was increasing after LC on comparison to the control, on comparison of the measurement before and after LC, we found no significant difference found in the first 2 weeks that became significant after 1 month. A similar result was found by Gill and Gupta,[16] while Malik *et al*.[17] found that no changes in HDL level on both measurements at 5$^{th}$ day and 6$^{th}$ month of follow-up, this difference in the finding may be attributed to the duration of the follow-up offered for the participants in comparison to the current study. Malik *et al*.[17] also found no significant difference at the 6$^{th}$ month.

The mean LDL after 1 month of LC was significantly lower than the initial reading, yet this level was not different from the control, thus it may be attributed to other factors other than the surgery. A similar result was found by Gill and Gupta,[16] while Malik *et al*.[17] also found a significant reduction in the level of LDL after 6 months, and Osman *et al*.[18] found significant reduction on 2, 4, and 6 months after LC. This reduction of LDL was not compared to the control as done in the current study, and this reduction may be attributed to the duration of the follow-up or other factors that affect the condition other than the surgery.

The mean VLDL was not different from the control, and not changed over time, this result was supported by the result found by other studies (Sergeev *et al*.,[15] Gill and Gupta,[16] Malik *et al*.,[17] and Osman *et al*.[18]).

The limitation of the study was the short period of follow-up, also the effect of diet although advice no change in diet but the exact diet may interfere with the outcome, finally, the effect of body response to trauma may attributed to some of the changes in LP, and this decreased after the use of measurement after 1 month.

## Conclusion

LC is associated with a reduction of the serum level of both TC and TG and an increase serum level of HDL after 1 month of follow-up.

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### Conflicts of interest

There are no conflicts of interest.

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