e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2022; 14(7); 378-384

Original Research Article

Evaluation of Serum Lipid Profile Correction after Laparoscopic Cholecystectomy in One Year Follow-Up

Sourabh Trivedi[1], Samir Anand[2], Rahul Jaggi[3], Saurabh Sharma[3]

[1]Junior Resident, Department of General Surgery, Maharishi Markandeshwar Medical College and Hospital, Solan, H.P., India

[2]Professor, Department of General Surgery, Maharishi Markandeshwar Medical College and Hospital, Solan, H.P., India

[3]Assistant Professor, Department of General Surgery, Maharishi Markandeshwar Medical College and Hospital, Solan, H.P., India

Received: 15-04-2022 / Revised: 20-05-2022 / Accepted: 05-06-2022
Corresponding author: Dr Saurabh Sharma
Conflict of interest: Nil

Abstract

Background: Gallstone disease is a prominent healthcare burden worldwide and is managed by laparoscopic cholecystectomy. The literature supports normalization of lipid profile after cholecystectomy after one month of follow-up. However, the change on long-term follow-up remains unascertained. The study examines the sustainability of lipid profile correction over one year follow-up.

Methods: A cohort of 108 subjects undergoing laparoscopic cholecystectomy were enrolled. Demographic details documented and values of fasting lipid profile at pre-operatively, one-week, 6 months and 12 months post-operatively were noted. The mean values of all lipid profile parameters were compared with the pre-operative levels.

Results: The first week post-operative follow-up only had significant increase in triglyceride (p-value: 0.02). Although, at six-month follow-up values of total cholesterol and low-density lipoprotein normalized (p-value: 0.01; 0.001 respectively), however, this correction was found ephemeral at twelve-month follow-up with comparable levels of all parameters to the pre-operative values.

Conclusion: Lipid profile values seem to normalize after laparoscopic cholecystectomy; however, this correction seems fugacious on long follow-up. To sustain this rectification after cholecystectomy, it is advisable to enfold lifestyle modifications which could prevent a subsequent risk of future cardiovascular event.

Keywords: Cholecystectomy, Demogarphic details, Lipid Profile, Lipoprotein

This is an Open Access article that uses a fund-ing model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0) and the Budapest Open Access Initiative (http://www.budapestopenaccessinitiative.org/read), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Background

Gallstones disease (GSD) is a benign hepatobiliary manifestation associated with dyslipidaemia [1]. It is a major healthcare problem worldwide affecting 10–15% adult population [1]. Biliary stones can be cholesterol, pigmented, or mixed in composition. Supersaturation, bile concentration, nucleation, crystallization and insufficient drainage of gallbladder are some causes of biliary stones formation. More than half of patients with gallstones have underpinning dyslipidaemia [2].

Functional correlation between lipid and bile acids metabolisms has been established. However, how cholecystectomy transmutes lipid profile is indecisive. Laparoscopic cholecystectomy, a gold-standard procedure for symptomatic gallbladder diseases, is assumed to improve the deranged lipid profile at one week and one month after surgery in the literature [1,3-5]. However, long-term relationship between cholecystectomy and serum lipid profile remains dubious, hence, this study will evaluate the effect of cholecystectomy on lipid profile for a duration of 12 months.

Materials and Methods

A prospective study was carried out in a tertiary care centre from 2019 to 2021 after acquiring approval of the Institutional Ethical Committee. An aggregate of one hundred thirty-six patients in the age group of 20-70 years, who underwent cholecystectomy, were enrolled in this study. Patient on lipid-lowering agents, patients with renal failure, liver disease, pancreatitis, cardiac failure, morbid obesity, hypothyroidism, hemoglobinopathies, diabetic, pregnancy, familial dyslipidemia, immunocompromised and defaulters were excluded from this study. After exclusion, one hundred eight participants were selected for the study (Figure 1). A detailed history to appraise any risk factor was pondered. Physical examination to evaluate the general condition and vitals was performed. Per abdominal examination findings were recorded and gallstone's presence was verified via ultrasonography. After taking the written informed patient's consent, laparoscopic cholecystectomy was performed.

To compute the lipid profile, two milliliters of fasting venous samples at preoperative, 1 week, 6 months and 12 months post-operatively were taken under all aseptic conditions. Serum was separated by centrifugation and processed for biochemical valuation. Serum lipid profile documented were serum total cholesterol (TC), high-density lipoprotein cholesterol (HDL), low-density lipoprotein (LDL), serum triglycerides (TG) and very low-density lipoprotein (VLDL).

Statistical Analysis

Data was analysed using SPSS Statistics, version 23 (IBM Corp., Armonk, NY; for Windows). All qualitative variables were expressed as frequencies and percentages, and quantitative variables as mean and standard deviation. The student paired t-test was used to compare the preoperative mean values of the lipid profile with different follow-up values. P-value $\leq$ 0.05 was considered significant.

Results

In 108 cohort population, female to male ratio was 2.3:1 comprising 82 (75.9%) females and 26 (24.1%) males. Age of the participants ranged between 20 and 69 years with the mean age of 46±18.6 years. Females had a mean age of 41±19.3 years and males had a mean age of 48±16.7 years. Maximum participants were in the age range of 35 and 55 years. The mean BMI of the cohort was 27±4.1 kg/m^2 comprising twenty-four patients having BMI above 30 kg/m^2.

The comparative analysis of lipid profile with respective p-values is explained in Table 1. Following are the descriptive observations in relation to lipid profile:

Pre-operative assessment

The TC value of all participants ranged between 115 mg/dL and 218 mg/dL. There were 17 (15.7%) participants with abnormal values (>200mg/dL). The maximum LDL value was 143 mg/dL and minimum value recorded was 74 mg/dL. Also, no patient had an abnormal LDL preoperatively. The range of HDL was 36 mg/dL to 57 mg/dL and of VLDL was 10 mg/dL to 32 md/dL.

First follow-up

After one week post-operatively, serum TG were found to be significantly increased (p-value: 0.02). The values of TC, LDL, HDL and VLDL all showed a decrease in the mean values, however, were inconsequential (p-value: 0.48, 0.33, 0.11 & 0.85). (Table 1)

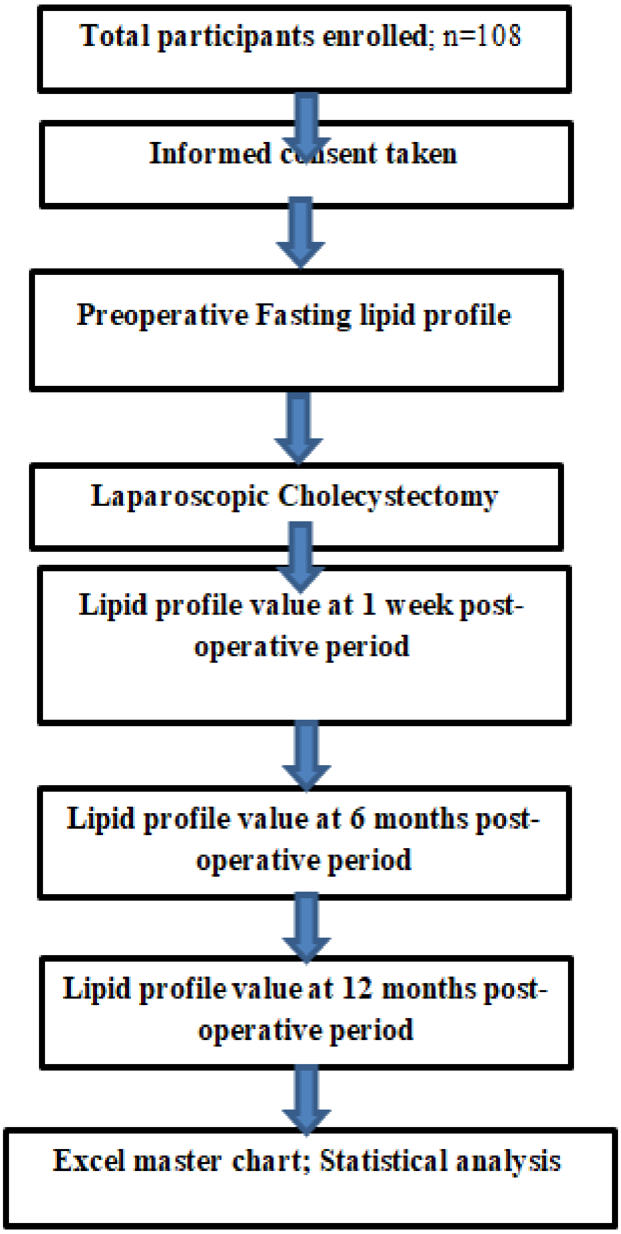

Figure 1: Schematic representation of the study design.

Table 1: The comparative analysis of lipid profile values at 1-week post-operative period. (p-value $\le$ 0.05 was considered as significant).

Parameter (mg/dL)	Total Cholesterol	Low Density Lipoprotein	High Density Lipoprotein	Triglyceride	Very Low-Density Lipoprotein
Pre-operative Value	155 ± 34.7	106 ± 27.2	47.3 ± 9.7	100.7 ± 42.1	20.87 ± 9.4
1 week Post-op	151 ± 26.1	102 ± 25.4	41.7 ± 8.9	112 ± 41.2	18 ± 9.1
p-value	0.48	0.33	0.11	0.02	0.85

Second follow-up

At 6 months post-operatively, TC and LDL levels were significantly lower compared to pre-operative levels (p-value: 0.01 & 0.001). However, the levels of HDL were significantly elevated from the pre-operative levels (p-value: 0.04). Though the levels of VLDL decreased but values remained indecisive. (Table 2)

Table 2: The comparative analysis of lipid profile values at 6 months post-operative period. (p-value $\leq$ 0.05 was considered as significant).

Parameter (mg/dL)	Total Cholesterol	Low Density Lipoprotein	High Density Lipoprotein	Triglyceride	Very Low-Density Lipoprotein
Pre-operative Value	155 ± 34.7	106 ± 27.2	47.3 ± 9.7	100.7 ± 42.1	20.87 ± 9.4
6 months Post-op	143 ± 35.8	91 ±34.2	54 ± 8.2	105.7 ± 48.2	15 ± 8.4
p-value	0.01	0.001	0.04	0.67	0.57

Third follow-up

The levels of all the variables were lower than the pre-operative levels, though the result was comparable. All participants were completely healthy after one year, also with no new symptom or sign on examination. (Table 3)

Table 3: The comparative analysis of lipid profile values at 12 months post-operative period. (p-value $\leq$ 0.05 was considered as significant).

Parameter (mg/dL)	Total Cholesterol	Low Density Lipoprotein	High Density Lipoprotein	Triglyceride	Very Low-Density Lipoprotein
Pre-operative Value	155 ± 34.7	106 ± 27.2	47.3 ± 9.7	100.7 ± 42.1	20.87 ± 9.4
12 months post-op	153 ± 39.1	104 ± 25.9	50.5 ± 8.9	103.4 ± 54.9	19 ± 8.1
p-value	0.73	0.28	0.33	0.17	0.94

Discussion

GSD is a multifactorial manifestation of altered environmental factors along with predisposing genetic factors. Incidence increases with age, however, it peaks around third to fifth decade.[1] Similarly, in our observations, most patients ranged between 34 and 57 years.

In the present study, females outnumbered males by 2.3 times, which is consistent with other studies. This substantiates that female have a higher risk of GSD occurrence [5,6]. Female gender preponderance, of two to three folds, is probably due to frequent hormonal alterations and changes during pregnancy. Also, oral contraceptives alter the secretion of cholesterol and bile acids, resulting in the supersaturation and an increase in lithogenicity of bile [1].

Increasing life expectancy, sedentary lifestyle, consumption of saturated fat, diabetes mellitus, hypertension, smoking and alcohol are associated risk factors leading to higher incidence of dyslipidaemia as a recent trend [7]. Dyslipidaemia further exacerbates risk of development and progression of cardiovascular disease. Therefore, it necessitates preoperative lipid profile assessment of all patients with GSD.

Serum TG levels significantly increased at one-week interval, thereafter, the levels decreased but with statistically insignificant results at the six-months and 12 months. Unanimously, this finding was shared by many studies, however, they observed a significant decrease even at one month [8,9]. This is because TG act as an energy source during the perioperative period. Therefore, catecholamines, produced post operatively augment lipolysis of adipose tissues, causing raised TG and glycerol levels [10].

Serum TC significantly decreased at six months following cholecystectomy. The literature also notices the decrease at intervals ranging from one to six months [3,5,8,11]. Cholecystectomy favours prompt circulation of bile acids owing to increased enterohepatic circulation. Therefore, diminution of bile acid pool ensues in the biliary system, which triggers consumption of cholesterol for replenishment of bile acid requirements.[12] Consequently, a surge in endocytosis of cholesterol into liver befalls by over-expression of the Apo B and Apo E receptors [12]. In contrast, few studies discerned a significant increase in TC levels post-operatively [13]. However, their study was retrospective and did not consider the duration after cholecystectomy as a variable.

Serum LDL cholesterol levels decreased post-cholecystectomy and were found to be statistically significant at six months postoperatively. Many studies support these findings [3,5,6,9]. After cholecystectomy, the requirement of cholesterol increases for replenishment of bile acid pool. LDL functions to transports cholesterol from the intestine (as chylomicron remnants) to the liver. The over-expression of the LDL-Apolipoprotein B (ApoB) receptor escalates LDL endocytosis from the blood into hepatocytes for supply of cholesterol to the intracellular cholesterol pool for bile synthesis [12]. This elucidates the decrease in LDL levels. However, few studies show conflicting results, but that may be due to difference in ethnicity, diet, inclusion of confounding factors and retrospective nature of these studies [4,13].

Serum HDL levels showed statistically insignificant reduction at one week, a finding supported by previous studies [3,5,6,9]. Post-operative inflammation and other factors, such as myeloperoxidase mediated oxidation, impairs HDL production and HDL function. This can elucidate its decrease in early post-operative period [14]. However, its level significantly increased at six months. As HDL is the key factor for reverse cholesterol transport from peripheral tissues, therefore, liver release HDL into bloodstream to replenish the bile acid pool caused due to raised enterohepatic circulation of bile [15]. This could be the possible rationale of this finding. Fascinatingly, serum VLDL level had insignificant changes throughout the follow-up of 12 months, analogous to previous publications [5].

The most interesting finding of this study was that though cholecystectomy changed the lipid profile during the six months' period but, at 12 months follow up, the levels returned to comparable levels to preoperative values. This contradicts the conclusion of many studies with short term follow up to consider cholecystectomy as a procedure which normalises the lipid profile. The explanation for this reversal may be the recommencement of high caloric, carbohydrate and lipid diet along with the sedentary lifestyle by the patient. As a result, studies noticed gain in weight and body mass index (BMI) after cholecystectomy [16]. Therefore, we recommend following healthy diet and routine cardiovascular drills after a laparoscopic cholecystectomy to sustain the normalised lipid profile over prolong period.

Dyslipidemia is a strong predictor of future cardiovascular event like stroke or coronary artery disease. Post-cholecystectomy improvement in lipid profile has been expected to decrease the risk of these events [17]. However, our study clearly shows that dyslipidemia is multifactorial disease and dependence on a procedure will be unjustified. There is available literature to show positive association between cholecystectomy and cardiovascular risk or metabolic syndrome [18]. Therefore, the study validates restitution of lipid profile after cholecystectomy, in-spite of this; we accentuate continuation of lifestyle modifications to protract the effect of these changes post-operatively.

Conclusions

Gallstone disease is amalgamated with a deranged lipid profile, which improves after cholecystectomy. However, this improvement seems transitory with time, hence, addition of lifestyle modifications could help in sustaining these positive effects of cholecystectomy, which might be beneficial in the prevention of subsequent cardiovascular event.

References

1. Di Ciaula A, Wang DQ, Portincasa P. An update on the pathogenesis of cholesterol gallstone disease. Curr Opin Gastroenterol. 2018;34(2):71-80.
2. Shen C, Wu X, Xu C, Yu C, Chen P, Li Y: Association of cholecystectomy with metabolic syndrome in a Chinese population. PloS One. 2014; 9:88189.
3. Jindal N, Singh G, Ali I, Sali G, Reddy R: Effect of cholelithiasis and cholecystectomy on serum lipids and blood glucose parameters. Arch Int Surg. 2013,3:97-101.
4. Mujibul Haq AM, Giasuddin ASM, Jhuma KA, Choudhury MAM. Effect of cholecystectomy on lipid profile in Bangladeshi patients with cholelithiasis. J Metab Syndr. 2015,5:192.
5. Gill GS, Gupta K: Pre- and post-operative comparative analysis of serum lipid profile in patients with cholelithiasis. Int J Appl Basic Med Res. 2017; 7:186-188.
6. Menezes JV, Katamreddy RR. The effect of cholecystectomy on the lipid profile of patients with gallstone disease: a prospective study. Int Surg J. 2019 Oct 24;6(11):4112-6.
7. Handelsman Y, Jellinger PS, Guerin CK, *et al*. Consensus Statement by the American Association of Clinical Endocrinologists and American College of Endocrinology on the Management of Dyslipidemia and Prevention of Cardiovascular Disease Algorithm - 2020 Executive Summary. Endocr Pract. 2020;26(10):1196-1224.
8. Ahi KS, Singh RP, Kaur H, Moudgil A. Serum lipid profile in pre and post cholecystectomy patients. Int J Anat Radiol Surg. 2017;6(2):1-6.
9. Al-Kataan MA, Bashi AY, Al-Khyatt MK. Some serum lipid profile and glucose levels pre-and post-cholecystectomy. J Bahrain Med Soc. 2010;22(1):18-22.
10. Jörgen N, Björn N, Tomas S, Wahrenberg H, Peter A. Catecholamine regulation of adipocyte lipolysis after surgery. Surg. 1991;109(4):488-496.
11. Malik A, Wani ML, Iqbal Tak S, Irshad I, Ul-Hassan N: Association of dyslipidaemia with cholilithiasis and effect of cholecystectomy on the same. Int J Surg. 2011, 9:641-642.
12. Osman A, Ibrahim AH, Alzamil AM, *et al*. Is Cholecystectomy in Patients with Symptomatic Uncomplicated Cholelithiasis Beneficial in Improving the Lipid Profile? Cureus. 2020;12(1):e6729. Published 2020 Jan 21.
13. Sabanathan S, Oomeer S, Jenkinson LR: Cholecystectomy or cholelithiasis - a missed marker for hyperlipidaemia? A combined retrospective and

prospective study. Gastroent Res. 2008, 1:29-32.
14. Fisher EA, Feig JE, Hewing B, Hazen SL, Smith JD. High-density lipoprotein function, dysfunction, and reverse cholesterol transport. Arterioscler Thromb Vasc Biol. 2012;32(12):2813-2820.
15. Farrer S. Beyond Statins: Emerging Evidence for HDL-Increasing Therapies and Diet in Treating Cardiovascular Disease. Adv Prev Med. 2018; 2018:6024747. Published 2018 Jul 9.
16. Kenary AY, Yaghoobi Notash A Jr, Nazari M, *et al*.: Measuring the rate of weight gain and the influential role of diet in patients undergoing elective laparoscopic cholecystectomy: a 6-month follow-up study. Int J Food Sci Nutr. 2012, 63:645-648.
17. Wei CY, Chuang SH, Lin CL, *et al*. Reduced risk of stroke following cholecystectomy: A nationwide population-based study. J Gastroenterol Hepatol. 2019;34(11):1992-1998.
18. Fairfield CJ, Wigmore SJ, Harrison EM. Gallstone Disease and the Risk of Cardiovascular Disease. Sci Rep. 2019;9(1):5830. Published 2019 Apr 9.