

ORIGINAL RESEARCH**Cholecystectomy: Long term effect on serum lipid profile and Vitamin D**Mohammad Fathi¹, Mohsen Soori², Fariborz Rashnoo^{2*}, Esmail Hajinasrollah³

1. *Resident of General Surgery. Department of General Surgery, Loghman Hakim Hospital, Shahid Beheshti University of Medical Sciences, Tehran, Iran*
2. *Assistant Professor of General Surgery. Department of General Surgery, Loghman Hakim Hospital, Shahid Beheshti University of Medical Sciences, Tehran, Iran*
3. *Professor of General Surgery. Department of General Surgery, Loghman Hakim Hospital, Shahid Beheshti University of Medical Sciences, Tehran, Iran*

*Corresponding Author:

Address: Department of General Surgery, Loghman Hakim Hospital, Shahid Beheshti University of Medical Sciences, Tehran, Iran.

Email: fariborz.rashnoo@yahoo.com

Date Received: April, 2018

Date Accepted: January, 2019

Online Publication: June 15, 2019

Abstract

Background: The association between cholecystectomy and abnormal lipids and later increase in the risk of diseases related to dyslipidemia showed controversial results. This study aims to evaluate the association of lipid profile and Vitamin D level before and after cholecystectomy.

Materials and Methods: Ninety-eight patients with symptomatic gallstones were studied prospectively. Plasma concentration of cholesterol, triglycerides, LDL, HDL and vitamin D was analyzed preoperatively and postoperatively after six months of cholecystectomy. None of the patients received any lipid-lowering drug or dietary restriction.

Results: Sixty-seven (68.4%) female and 31 (31.6%) male patients were studied for six months. There was a significant increase in total serum cholesterol besides a significant decrease in vitamin D and HDL serum level after six months. Also, there was a non-significant increase in the serum level of LDL and triglyceride. In stone based sub analysis the same results achieved.

Conclusion: There was a significant decrease in plasma concentration of vitamin D and HDL and the significant increase in cholesterol, triglyceride, and LDL in cholecystectomy patients postoperatively. These changes in plasma lipids and Vitamin D are likely to have a significant effect on the development of different disease related to dyslipidemia such as coronary artery disease and low bone density after cholecystectomy in the long term.

Keywords: Cholesterol, Cholecystectomy, Triglycerides, vitamin D

Introduction

Gallstone disease is one of the common gastrointestinal diseases with a substantial burden to the health-care delivery system (1). Cholelithiasis is one of the most common gastrointestinal disorders being prevalent in about 10-15% of adults in developing countries (2). The most common symptom of gallbladder stones are severe abdominal pain, and surgical removal of the gallbladder is the treatment of choice by the time they are symptomatic (3).

It is now widely accepted that the primary event in the pathogenesis of cholesterol gallstones is an altered lipid metabolism, because of which there is a relative increase in the cholesterol levels compared to other lipids secreted by the liver into the bile (4).

Many studies have shown an association between cholecystectomy and abnormal lipids. Even though lipid and bile acid metabolisms are functionally related, there are different results about long-term effects of gallbladder removal on serum lipids and vitamin D as fat-soluble nutrition (5-7). This study aimed to determine the long-term pattern of serum levels of lipids and vitamin D change in patients with gallbladder stone before and after cholecystectomy.

Materials and Methods

In this prospective study, 98 patients with symptomatic cholelithiasis (based standard clinical and laboratory criteria as practiced in the hospital) who were a candidate for cholecystectomy were enrolled in the study.

After obtaining permission from the Ethics Committee of Shahid Beheshti University of Medical Sciences, and obtaining consent, patient's details and clinical findings including detailed lipid profile (serum cholesterol, triglycerides, LDL cholesterol, and HDL cholesterol) and vitamin D of all patients was obtained preoperatively were recorded.

All these patients underwent cholecystectomy subsequently for symptomatic cholelithiasis. Patients were followed for six months and a lipid profile and Vitamin D level at six months postoperatively was also obtained. None of the patients was put on any lipid-lowering drug Vitamin D complement or any dietary restriction.

The results in patients (pre and postcholecystectomy) were compared

statistically by paired t-test, and Wilcoxon ranks test (in case of skewed distribution) with SPSS-23.

Results

Ninety-eight patients including 31 males and 67 females participated in this study. The mean age and average body mass index of patients were 45.2±12.7 and 31.24±8.3 kg/m² respectively.

The mean levels of serum cholesterol significantly elevated while HDL and vitamin D significantly reduced after six months of post-operation (Table 1).

Table 1- Serum levels of TG, TC, LDL, HDL and Vitamin D before and after surgery in all patients.

Lipid Profile	Before Surgery (n=98)	After Surgery(n=98)	p-value
Cholesterol	168.95±47.92	181.40±46.58	*0.047
LDL	107.68±39.4	111.29±41.1	‡0.23
HDL	48.82±10.2	45.55±12.2	‡0.019
TG	136.42±66.8	138.25±81.7	‡0.42
Vitamin D	36.46±18.1	31.98±14.1	*0.037

*Paired T-test

‡Wilcoxon Ranks Test

Same results achieved in the subanalysis of data, based gallbladder stone type (Table 2).

Table 2- Serum levels of TG, TC, LDL, HDL and Vitamin D before and after surgery in patients with different stone type.

Stone Type	Lipid Profile	Before Surgery	After Surgery	p-value
C (n=60)	Cholesterol	132.53±34.6	178.46±40.9	0.001<*
	LDL	106.15±40.5	135.26±35.6	‡0.16
	HDL	45.46±11.6	36.92±7.6	‡0.003
	TG	120.19±38.6	123.61±34.15	‡0.40
	Vitamin D	42.61±16.9	32.77±16.2	0.020*
P (n=26)	Cholesterol	132.53±34.6	178.46±40.9	<0.001*
	LDL	106.15±40.5	135.26±35.6	‡0.16
	HDL	45.46±11.6	36.92±7.6	‡0.003
	TG	120.19±38.6	123.61±34.15	‡0.40
	Vitamin D	42.61±16.9	32.77±16.2	0.020*
MIX (n=12)	Cholesterol	135.25±33.6	173.00±39.6	0.001*
	LDL	100.16±45.8	105.91±37.3	‡0.19
	HDL	48.16±16.6	36.58±7.9	‡0.025
	TG	89.66±35.4	94.50±76.2	‡0.15
	Vitamin D	35.00±11.8	24.07±6.9	0.025*

*Paired T-test

‡Wilcoxon Ranks Test

The biochemical analysis of stones revealed that the majority of stones were cholesterol stones (61.2%) followed by pigment stones (26.5%) and mix (12.2%). Seventy-nine (80.6%) of patients presented with multiple stones.

Discussion

This study aimed to investigate the changes in lipid profiles and serum vitamin D level after cholecystectomy. The results of this study showed the comparison to the measured lipid profile serum level before cholecystectomy, after six months, the level of cholesterol significantly increased, as well as HDL,

Vitamin D significantly decreased. Serum levels of LDL and triglyceride also increased, but this increase was not statistically significant.

Recently, investigators focus on changes in lipid profile in patients with cholelithiasis after cholecystectomy. The importance of the aspect of cholelithiasis treatment is that it can be helpful to the decision-making through pharmacological interventions to normalize lipid profile and vitamin D after surgery to prevent further more complications due to lipid profile and vitamin D imbalance in the long term.

In an animal study by Javed et al., cholecystectomy results in a significant increase in plasma levels of TC, TG, VLDL, and LDL (5). Other studies on animal models showed that, during the formation of cholesterol gallbladder stone, the HDL-C receptors on hepatocytes were reduced that caused a significant decrease of HDL after cholecystectomy (8).

So far, various clinical studies have been conducted in this area, which in most cases only investigate the level of lipid profile in the early days after surgery. Moazeni Bistgani et al., found that LDL, TG, total cholesterol and HDL serum levels significantly reduced three days after cholecystectomy (7). Malik et al. study, also showed the same results, and there were a significant decrease in total cholesterol, TG and LDL serum levels three days after cholecystectomy (9). However, Gills et al. showed that in third days after cholecystectomy, LDL serum levels increased significantly; While after one month, LDL levels start to decrease(10).

However, other studies have shown different results in the long-term follow up. In the study, Juvonen et al. Showed that after one year, patients undergoing cholecystectomy experienced a significant increase in LDL serum level (11). Another study by Walmsley and colleagues also showed that although total cholesterol levels decreased six days after cholecystectomy, but significantly increased after six months (12).

The results of this study, consistent with the results of the two recent studies, showed that in the long term follow up after cholecystectomy, patients had a significant increase in the profile of the lipid profile.

Reduce of Vitamin D serum level after six months was another finding in this study. Polat et al. showed that early cholecystectomy in women could be associated with a significant reduction in vitamin D and bone density in the long term (13). In other studies, this finding confirmed that cholecystectomy could be associated with chronic vitamin D deficiency (14). The results of this study, consistent with the results of previous studies, showed that cholecystectomy could be related to vitamin D deficiency in the long term.

In the discussion, although cholecystectomy in the short term can reduce the level of lipid profiles in patients and, in the long term, patients experience high serum level of serum lipids that may cause to risk of dyslipidemia related disease in the absence of appropriate post-surgical medical care strategies. Also, given the significant reduction in vitamin D levels in these patients, long-term use of proper diet or vitamin D supplements can be helpful to the prevention of vitamin D deficiency. It is suggested that multiple measurements of serum lipids level and vitamin D after surgery in a long time, as well as designing clinical trials, could help the physicians with better understand of the lipid profile and vitamin D changes pattern after cholecystectomy and their management.

Acknowledgement

The authors would like to thank the Clinical Research Development Unit (CRDU) of Loghman Hakim Hospital, Shahid Beheshti University of Medical Sciences, Tehran, Iran, for their support, cooperation and assistance throughout the period of study.

Conflict of interest

Authors declare no conflict of interest.

References:

1. Sandler RS, Everhart JE, Donowitz M, Adams E, Cronin K, Goodman C, et al. The burden of selected digestive diseases in the United States. *Gastroenterology*. 2002;122(5):1500-11.
2. Batajoo H, Hazra NK. Analysis of serum lipid profile in cholelithiasis patients. *Journal of Nepal Health Research Council*. 2013;11(23):53-5.
3. Jaraari AM, Jagannadharao P, Patil TN, Hai A, Awamy HA, El Saeity SO, et al. Quantitative analysis of gallstones in Libyan patients. *The Libyan journal of medicine*. 2010;5:10.4176/091020.
4. Peela J, Jarari A, El Awami H, Patil T. Lipid Profile in Bile and Serum of Cholelithiasis Patients--A Comparative Study 2012.
5. A.H. Jawad NAA, I.J. Al-Assadi. Action of cholecystectomy and the alcoholic extract of *Taraxacum officinal* leaves on plasma lipid profile in rabbits. *Journal of Basrah Researches (Sciences)*. 2006;32(1):7.
6. Zhao J-C, Xiao L-J, Zhu H, Shu Y, Cheng N-S. Changes of lipid metabolism in plasma, liver and bile during cholesterol gallstone formation in rabbit model. *World journal of gastroenterology*. 1998;4(4):337-9.
7. Moazeni bistgani M, Kheiri S, Ghorbanpour K. The effects of cholecystectomy on serum lipids during one year follow-up 2014.
8. Zhao J, Xiao L, Zhu H, Shu Y, Cheng N. [Change of serum lipid, apolipoprotein during cholesterol gallstone formation in rabbit model]. *Hua xi yi ke da xue xue bao = Journal of West China University of Medical Sciences = Huaxi yike daxue xuebao*. 1997;28(4):361-4.
9. Malik AA, Wani ML, Tak SI, Irshad I, Ul-Hassan N. Association of dyslipidaemia with cholilithiasis and effect of cholecystectomy on the same. *International journal of surgery (London, England)*. 2011;9(8):641-2.
10. Gill GS, Gupta K. Pre- and Post-operative Comparative Analysis of Serum Lipid Profile in Patients with Cholelithiasis. *International journal of applied & basic medical research*. 2017;7(3):186-8.
11. Juvonen T, Kervinen K, I Kairaluoma M, Kesaniemi A. Effect of cholecystectomy on plasma lipid and lipoprotein levels 1995. 377-82 p.
12. Walmsley MJ, Waddecar J, Schofield PF. Serial serum cholesterol estimations after biliary-tract surgery. 1970;57(11):829-31.
13. Polat HB, Beyazal MS. The effect of cholecystectomy on 25-hydroxyvitamin D levels and bone mineral density in postmenopausal women. *Archives of osteoporosis*. 2018;13(1):61.
14. Stoker GE, Buchowski JM, Stoker ME. Prior Cholecystectomy as a Predictor of Preoperative Vitamin D Deficiency in Adults Undergoing Spine Surgery. *Archives of Surgery*. 2012;147(6):577-8.