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Effects of cholecystectomy on lipid profile

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Abstract

Cholecystectomy is widely used to treat gallstone disease as one of the surgical procedures which have been most frequently performed worldwide. The bile acids pool has unchanged size, but it has fast circulation, which causes to expose the enterohepatic organs to increased flux of bile acids per day in cholecystectomized patients. This study aims to evaluate blood lipid levels before and after cholecystectomy. The total number of 80 consecutive patients underwent elective cholecystectomy were included in this study. Lipid parameters, biochemical analysis was obtained before surgery and after 12 weeks of cholecystectomy. Mean age was 49±13. Sixty (75%) patients were female. None of the subjects died during perioperative course. Levels of total cholesterol (191.9 ±37.1 mg/dl vs. 186.1 ±36.8 mg/dl, respectively; p=0.006), LDL-C (142.6±41.7 mg/dl vs. 133.9±35.1 mg/dl, respectively; p<0.001) were significantly reduced after eight weeks of cholecystectomy, whereas triglyceride and HDL-C levels were not significantly altered. This study demonstrated that cholecystectomy causes a significant reduction of LDL and total cholesterol levels. Prospective randomized studies should help for determining of possible clinical positive effects of cholecystectomy on atherosclerosis.

Keywords: atherosclerosis, blood cholesterol, cholecystectomy, gallstone

1. Introduction

The gallbladder supports the maintenance of lipid homoeostasis of the human body. The gallbladder plays an essential role in the digestion and absorption of lipid by concentrating and storing hepatic bile. Water is the main component of bile, the initial excretory route for organic compounds such as low water solubility drugs, lipid hormones, and cholesterol (1-2). Peripheral uptake and cholesterol synthesis are mainly located in the hepatocyte, and excess cholesterol is converted into bile salts or directly secreted into bile (3).

Cholecystectomy is widely used to cure gallstone disease as one of the surgical procedures most frequently performed worldwide. It is generally accepted that gallbladder removal is a benign condition without negatively affecting the normal health status or overall metabolic regulation. In fact, digestion and absorption of dietary fats and lipid-soluble vitamins are normal after cholecystectomy (4).

The bile acids pool has an unchanged size, but it has fast circulation, which exposes the enterohepatic organs to increased flux of bile acids per day in cholecystectomized patients (5-8).

Due to the fast circulation of the bile after cholecystectomy, the higher flux of molecules of bile acids per unit time could affect blood lipid levels. This study aimed to evaluate levels of blood lipid before and after cholecystectomy.

2. Materials and Methods

2.1. Subjects

Eighty consecutive patients undergoing elective cholecystectomy participated in this study. We conducted a detailed examination of all participants through physical examinations and taking medical histories such as lifestyle habits. We excluded the patients who received statin and fibrate therapy, had alcohol intake above 30 g per day, acute cholecystitis, liver failure, familial hypercholesterolemia, renal failure, or hypertriglyceridemia. We obtained lipid parameters and conducted biochemical analysis before surgery and after 12 weeks of cholecystectomy. We abided by the Declaration of Helsinki to have the protocol approved by the local ethics committee and received informed consent from all patients.

2.2. Cholecystectomy

We performed laparoscopic cholecystectomy using the four-trocar technique (10 mm umbilical, 10 mm subxiphoid, 5 mm subcostal and 5 mm midaxillary line).

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Extra trocars may be helpful in complex cases, but we did not use them. For patients with suspected intra-abdominal adhesions, we placed the first trocar using the open technique and the others by visual assistance.

We initiated dissection with adhesions and followed by Callot's triangle, applied double clip after the cystic artery and duct dissection and performed cholecystectomy. We routinely extracted the gall bladder from a 10 mm subxiphoid trocar and used endobag for patients with perforation.

2.3. Lipids measurement

We took fasting blood samples from participants' antecubital veins after fasting of >12 hours. We let the blood samples clot at room temperature for 20-30 minutes and then centrifuged them at 3000 xg for five minutes and froze them to below -800C until analysis. We performed enzymatic colorimetric tests to measure triglycerides (Lot No: C186, Konelab) and total cholesterol (Lot No: B540, Konelab) while performing the homogeneous enzymatic colorimetric test to measure high-density lipoprotein-cholesterol (HDL-C) (Lot No: C136, Konelab) and low-density lipoprotein-cholesterol (LDL-C) (Lot No: C435, Konelab).

2. 4. Statistical analysis

We used the Kolmogorov-Smirnov test to determine the distribution of the continuous variables. We expressed variables with skew distribution as median (minimum-maximum), continuous normally distributed variables as mean±SD, and categorical variables as percentage. We used the Wilcoxon rank-sum test for skew distributed variables and the paired sample t-test for variables with normal distribution. We identified correlations between study parameters through Spearman and Pearson analyses. A p-value<0.05 showed statistical significance in all statistics. We used SPSS 10.0 for Windows for all analyses.

3. Results

Eighty patients participated in the study. The mean age was 49±13. Sixty (75%) patients were female. None of the subjects died during the perioperative course. We performed open cholecystectomy in four patients and laparoscopic in 76 patients. The mean hospitalization duration was 2.1±0.3

Nine patients were (11%) diabetic, while 14 (17%) were hypertensive. There was no significant change in alanine aminotransferase (ALT) or gamma-glutamyltransferase (GGT) levels, plasma fasting glucose or aspartate aminotransferase (AST) after cholecystectomy.

Table 1 shows the effects of cholecystectomy on lipid and biochemical parameters. Levels of total cholesterol (191.9±37,1 mg/dl vs. 186.1±36.8 mg/dl, respectively; p=0.006) and LDL-C (142.6±41.7 mg/dl vs. 133.9±35.1 mg/dl, respectively; p<0.001) decreased significantly after eight weeks of cholecystectomy. Triglyceride (147.3±75.2 mg/dl vs 144.2±68.2 mg/dl, respectively; p=NS) and HDL-C levels (39.8±9.2 mg/dl vs. 38.7±8.3 mg/dl, respectively; p=NS) did not change significantly after eight weeks of cholecystectomy.

Table 1. Biochemical parametres before and after cholecystectomy

	Before cholecystectomy	After cholecystectomy	p-value
Fasting plasma glucose (mg/dl)	100.8±18.8	99.7±17.5	NS
Triglyceride (mg/dl)	147.3±75.2	144.2±68.2	NS
Total cholesterol	191.9±37.1	186.1±36.8	0.006
LDL-cholesterol (mg/dl)	142.6±41.7	133.9±35.1	<0.001
HDL-cholesterol (mg/dl)	39.8±9.2	38.7±8.3	NS
GGT (U/l)	29±3.7	28.5±5.1	NS
ALT (U/l)	29.2±3.7	30.1±3.4	NS
AST (U/l)	24.3±5.8	26.1±4.2	NS
Creatinine (mg/dl)	0.8±0.1	0.8±0.1	NS

ALT, alanine aminotransferase; AST, aspartate aminotransferase; HDL, high-density lipoprotein-cholesterol; LDL, low-density lipoprotein-cholesterol

4. Discussion

This study evinced a significant decline in LDL-C and total cholesterol levels after eight weeks of cholecystectomy, whereas HDL-C and triglyceride levels did not change significantly.

Several controversial studies evaluated the impact of cholecystectomy on lipid levels. Juvonen et al. demonstrated that LDL cholesterol and plasma total levels significantly decreased in cholecystectomy patients at day three following the operation. The values returned to the preoperative level thereafter in 19 patients (9). Malik et al. reported a significant reduction of the plasma concentration of triglycerides, total cholesterol, and LDL cholesterol in patients on the third day of surgery and after six months in 73 patients (10). Van der Linden et al. demonstrated that removing the functioning gallbladder caused irregular but accelerated flow of activity to the duodenum using 99mTc-HIDA (11). Decreased total and LDL cholesterol levels may be associated with this higher flux of bile per unit time. Accelerated enterohepatic bile flow causes more excretion of bile acids and cholesterol from the liver. It may result in lower blood cholesterol levels.

Cholecystectomy does not negatively affect normal health status or total metabolic regulation as a benign condition. Lipid soluble vitamins and dietary fats are normally digested and absorbed after cholecystectomy. This study included a positive effect of cholecystectomy (4). Dyslipidemia is a major risk factor for cardiovascular diseases, and LDL cholesterol is highly crucial information and progression of atherosclerosis (12-13). Decreasing total and LDL cholesterol levels may prevent this process. Clinical trials evinced cardiovascular disease risk reduction by about 2% through a 1% reduction of serum total cholesterol level. Statins trials indicate a risk reduction by about 1% through a 1% decrease of LDL cholesterol (14). We found 9 mg/dl (6%) LDL reduction after cholecystectomy. This LDL reduction may be related to an amazing effect of cholecystectomy.

Amigo et al. showed higher serum TG and hepatic concentrations in cholecystectomized mice (15). They suggested that systemic metabolic homoeostasis vitally required gallbladder function, and cholecystectomy might not be harmless. Our study did not support their findings. We found that cholecystectomy had no significant effect on triglyceride levels in humans.

This study demonstrated that cholecystectomy caused a significant reduction of LDL and total cholesterol levels. Furthermore, the results of this study showed that cholecystectomy did not affect triglyceride and HDL-C levels. Cholecystectomy is essential in preventing atherosclerosis and comorbid diseases related to atherosclerosis by reducing LDL and total cholesterol levels. Prospective randomized studies should help determine possible clinical positive effects of cholecystectomy on atherosclerosis.

Conflict of interest

Authors of this study do not have any conflict of interest.

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Authors' contributions
Concept: A.A., D.Ö., C.K., Design: A.A., D.Ö., Data Collection or Processing: A.A., D.Ö., Analysis or Interpretation: A.A., D.Ö., Literature Search: A.A., Writing: D.Ö.

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