

Evaluation of Hyperlipidemia in Patients with Gallstones

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Abstract

Introduction: Gallstone disease is one of the biggest global public health problems. The most common complications associated with gallstone disease include cholecystitis, pancreatitis, and cholangitis. The current study aimed to show that serum lipids have a significant role in the etiology of cholelithiasis.

Methods: Before surgery, all patients had blood samples taken. Lipid profile tests including very low-density lipoprotein cholesterol (VLDL-C), low-density lipoprotein cholesterol (LDL-C), high-density lipoprotein cholesterol (HDL-C), triglycerides (TG), and total cholesterol (TC) were performed on the serum, which was collected using standard procedures.

Results: The results showed that mean serum lipid levels were significantly different ($P < 0.001$) between the patients and the control group. In addition, the study revealed statistically significant differences between the genders ($P < 0.001$); in other words, significant differences were found between males and females in patients and controls in mean serum TC, HDL, and TG levels. On the other hand, the findings of the study indicated a notable rise ($P < 0.001$) in serum TC, triglyceride, and HDL levels in the age category 40-59 years, followed by the age category ≥ 60 years and the age category 29-39 years.

Conclusion: Overall, changes in serum lipid profile are a possible consequence of the presence of gallstones; in other words, serum TC, HDL, and TG levels were significantly higher in patients with gallstone disease compared to the control group.

Keywords: Lipid profile, Gallstone, Cholesterol, Triglyceride

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Introduction

Biliary tract pain is frequently caused by gallstones. Gallstone disease is one of the biggest global public health problems. The most common complications associated with gallstone disease include cholecystitis, pancreatitis, and cholangitis.¹ The majority of gallstone disease patients are asymptomatic, and after ten years of follow-up, about one-fifth of patients exhibit symptoms.² These individuals are reported to have silent gallstones, meaning they do not experience any pain. Additionally, the risk of gallstone disease increases with age.³ In industrialized countries, between 10% and 15% of the adult population suffers from gallstones, and gallstones affect women more often than they do males.⁴ There are varied forms of gallstones (cholesterol, black pigment, and brown pigment gallstones) with different pathogeneses and risk factors.⁵ In industrialized countries, cholesterol stones account for about 90% of all gallstones. They are mainly composed of cholesterol monohydrate (> 50%) along with other components such as calcium salts, bile pigments, proteins, and fatty acids. The pigment stones are mainly composed of calcium bilirubinate and contain less than

20% cholesterol.⁶ Cholesterol is a water-insoluble lipid and is taken in mixed micelles and vesicles. Vesicles are closed spherical bilayers of phospholipids with corresponding cholesterol, while micelles are aggregates of phospholipids, bile salts, and cholesterol.⁷ Gallstone formation occurs in three stages: nucleation, aggregation, and supersaturation.⁸ The amount of cholesterol that is soluble in bile depends on the relative amounts of cholesterol, phospholipids, and bile salts. An imbalance of these three lipid components of bile (cholesterol, bile salts, and phospholipids) causes cholesterol precipitation.⁹ Furthermore, alterations in the composition of bile have been intimately linked in recent times to problems with lipid metabolism in the liver.¹⁰ Complex aggregates of proteins and lipids known as lipoproteins (very low-density lipoprotein [VLDL], low-density lipoprotein (LDL), and high-density lipoprotein [HDL], and chylomicrons) make the lipids compatible with the aqueous environment of body fluids.^{11,12} The link between hyperlipidemia and gallstones is a topic of debate. Gallstones and hyperlipidemia have been significantly linked in certain studies.^{13,14} Therefore, the current study aimed to show that serum lipids have a significant role



in the etiology of cholelithiasis, which may indicate that serum lipids play a significant part in the pathophysiology of gallstone formation.

Materials and Methods

This study was carried out between August and December 2023. The samples were collected and sent to specialized laboratories of Baqubah Teaching Hospital in Baqubah city, Diyala, Iraq. A total of 50 patients were enrolled in the study based on inclusion criteria. A total of 30 healthy individuals without a history of gallstones were included in the study. The study population comprised male and female patients with gallstone disease. Gallstone disease was diagnosed by a specialist in patients with signs and symptoms. Then, the individuals were referred to a laboratory for further testing, and an abdominal ultrasound was carried out. After being informed of the study objectives and receiving a unique questionnaire intended to gather data, each participant provided their informed consent. The parameters (TC, TG, etc) were measured using Spinreact kits from Spain and HDL-C Biolabo kits from France. The Friedewald equation was used to estimate LDL-C and VLDL-C levels.⁹

Exclusion Criteria

Patients with a history of hepatobiliary or pancreatic surgery that altered the function and normal structure of the biliary tract, patients with hemolytic disorders, patients taking diuretics, patients with thyroid disorders, and patients with chronic renal disease were excluded from the study.

Statistical Analysis

The data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 27.0 software. The mean (\pm standard deviation) was used to express the data. In the current study, *t*-test and chi-square were used to analyze the data. $P < 0.05$ was established as a threshold level for statistical significance.

Results

In this study, 80 subjects (50 patients and 30 controls) were included. The mean age of the patients and controls

were 46.84 ± 14.61 and 45.83 ± 14.23 years, respectively. Based on the results, 54% ($n = 27$) of patients and 46.7% ($n = 14$) of controls were male. Moreover, 46% ($n = 23$) of the patients and 53.3% ($n = 16$) of the controls were female. As indicated in Table 1, mean serum lipid levels were significantly different ($P < 0.001$) between the patients and the control group. As illustrated in Tables 2, 3, and 4, statistically significant differences ($P < 0.001$) were found between males (27 vs 14) and females (23 vs 16) in patients and controls in mean serum TC, triglyceride, and HDL levels. The age of the participants ranged from 29 to 82 years. The gallstone patients under investigation were divided into three groups according to age (Tables 2, 3, and 4). The results of the study showed that there was a significant increase ($P < 0.001$) in serum TC, triglyceride, and HDL levels in the age category 40-59 years, followed by the age category ≥ 60 years and the age category 29-39 years.

Discussion

One of the most common digestive diseases is gallstones. It can arise anywhere in the biliary system, including the common bile duct and the gallbladder.¹⁵ In the current investigation, the mean serum TC level of the patients was higher than that of the control group. This indicates a positive correlation between blood cholesterol levels and gallstone disease. A previous study showed comparable findings.¹⁶ The relationship between high serum cholesterol levels in patients and gallstones is debatable in the literature and can be attributed to a variety of factors, including genetics, geography, social status, and dietary habits.¹⁷ According to this study, the mean serum triglyceride level of the patients was considerably higher than that of the control group, which agreed with a previous study.¹⁸ The main components of cholesterol-containing gallstones are TG and cholesterol. Cholesterol saturation of the bile duct due to hepatic hypersecretion of cholesterol plays a role in the pathophysiology of cholesterol gallstones.¹⁹ The patients in the current study had considerably lower mean serum HDL levels compared to the control group, which is consistent with a previous study indicating that low HDL and high TG were linked to

Table 1. Mean Lipid Levels in Research Groups

Lipid Profile Mean \pm SD (mg/dL)	Patients (n=50)	Controls (n=30)	P Value
TC	230.86 \pm 19.45	194.09 \pm 53.47	0.003
TG	203.62 \pm 30.89	158.89 \pm 28.36	0.002
HDL	45.64 \pm 8.46	54.56 \pm 13.34	0.004
LDL	144.49 \pm 22.34	107.74 \pm 53.68	0.005
VLDL	40.72 \pm 6.17	31.77 \pm 5.67	0.002

SD: standard deviation, TC: total cholesterol, HDL: high-density lipoprotein, TG: triglycerides, LDL: low-density lipoprotein, VLDL: very low-density lipoprotein.

Table 2. Mean Total Cholesterol Levels in Research Groups

Variables	Patients		Controls		P Value
	N	Mean (\pm SD)	N	Mean (\pm SD)	
Gender					
Male	27	234.44 \pm 20.94	14	189.72 \pm 51.27	0.004
Female	23	226.65 \pm 17.02	16	197.91 \pm 56.70	0.027
Total	50	230.86 \pm 19.45	30	194.09 \pm 53.47	
Age (y)					
29-39	22	229.36 \pm 23.33	13	189.63 \pm 59.86	
40-59	17	232.70 \pm 16.97	9	185.84 \pm 49.93	0.001
≥ 60	11	231.00 \pm 15.45	8	210.62 \pm 51.35	
Total	50	230.86 \pm 19.45	30	194.09 \pm 53.47	

Table 3. Mean Triglyceride Levels in Research Groups

Variables	Patients		Controls		P Value
	N	Mean (\pm SD)	N	Mean (\pm SD)	
Gender					
Male	27	206.22 \pm 33.34	14	146.76 \pm 21.14	0.001
Female	23	200.56 \pm 28.16	16	169.51 \pm 30.17	0.002
Total	50	203.62 \pm 30.89	30	158.89 \pm 28.36	
Age (y)					
29-39	22	199.81 \pm 28.54	13	150.22 \pm 23.02	
40-59	17	206.88 \pm 33.41	9	160.74 \pm 16.07	0.001
\geq 60	11	206.18 \pm 33.49	8	170.91 \pm 42.66	
Total	50	203.62 \pm 30.89	30	158.89 \pm 28.36	

cholelithiasis.²⁰ In addition, the study found that the mean serum levels of LDL and VLDL were higher in patients than in the control group. This result was in concordance with a previous study.²¹ The current study observed higher triglyceride, TC, and LDL levels, along with reduced HDL levels in females than in males in the patients as compared to the controls. This is consistent with many previous studies indicating that in both male and female gallstone patients, there was a positive correlation between lower levels of HDL and elevated levels of LDL, TG, and TC.^{22,23} Moreover, in a previous study, gallstones were more prevalent in females than males.²⁴ In the current study, in comparison to the control group, the patients in the age group of 40–59 years had lower HDL levels and higher levels of TC, TG, and LDL. This is consistent with a study indicating that patients with gallstones over the age of 20 had a marked increase in gallstones, especially in females, and then a progressive drop after the age of 60. It is possible that this is because the patients were admitted when they were younger and had fewer complications because the surgery was done when the illness was at an earlier stage. In general, gallstones of any type are rare before the age of 10 years. In general, the prevalence of gallstone disease often remains low until the start of puberty, at which it starts to rise.²⁵

Conclusion

In the current investigation, this implies that changes in serum lipid profile are a possible consequence of the presence of gallstones, particularly when there is biliary obstruction. It should be noted that only few gallstone patients had previously had biliary obstruction symptoms. However, it is impossible to completely rule out the possibility of relatively more lipid profile alterations brought on by gallstones. There are certain limitations to be mentioned. First, a small sample size could restrict how broadly the findings can be applied. Second, the research was dependent on self-reported information, which could be prone to memory bias. More studies with larger sample sizes and diverse populations are required to confirm the

Table 4. Mean HDL Levels in Research Groups

Variables	Patients		Controls		P value
	N	Mean (\pm SD)	N	Mean (\pm SD)	
Gender					
Male	27	45.42 \pm 9.36	14	51.05 \pm 14.48	0.007
Female	23	45.89 \pm 7.46	16	57.63 \pm 11.86	0.005
Total	50	45.64 \pm 8.46	30	54.56 \pm 13.34	
Age (y)					
29-39	22	43.70 \pm 9.16	13	52.94 \pm 12.27	
40-59	17	49.78 \pm 7.33	9	50.60 \pm 15.78	0.001
\geq 60	11	43.12 \pm 6.62	8	61.66 \pm 10.58	
Total	50	45.64 \pm 8.46	30	54.56 \pm 13.34	

results and assess the generalizability of the findings.

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Authors' Contribution

Conceptualization: Aseel J. Kadim, Luay Qasim Abdulhameed.

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Methodology: Aseel J. Kadim.

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Competing Interests

There is no conflict of interests.

Ethical Approval

The study was approved by the local Ethics Committee of the College of Education for Pure Sciences, University of Diyala.

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