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Original Research Article

Lipid Metabolic Disturbances and Postoperative Liver Enzyme Dynamics in Women with Gallbladder Disease in Dhi Qar Governorate

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Abstract: ***Background:*** Gallbladder disease is one of the prevalent hepatobiliary disorders, which are often accompanied by metabolic abnormalities, especially dyslipidemia. Nevertheless, in uncomplicated cases, abnormalities in the baseline liver function are not always present. Also, there are temporary changes in liver enzymes after laparoscopic cholecystectomy, although there is limited data of certain region populations. ***Aims:*** The purpose of the research was to test the differences in lipid profiles and liver biochemistry between women with the gallbladder disease and healthy control groups, and to determine the changes in liver enzymes in the short term after laparoscopic cholecystectomy surgery in Dhi Qar Governorate. ***Methods:*** This was a case control study and prospective observational study. One hundred and thirty-five female patients with a known case of gallbladder disease who are between 30 and 45 years were matched with one hundred and thirty-five healthy seemed controls. All subjects were of regular menstrual cycles and none had a history of chronic psychosis or malignancy. Tests of serum lipid profile and liver functioning were obtained after overnight fasting. They also followed 100 patients who were having elective laparoscopy cholecystectomy and biochemical measurements were conducted before surgery, at 24 and 72 hours of operation. There were statistical analyses of independent and paired t-tests, where $p < 0.05$ is statistically significant. ***Results:*** The patients with gallbladder disease had much higher serum levels of total cholesterol, low-density lipoprotein cholesterol and triglycerides, and much lower levels of high-density lipoprotein cholesterol in comparison with the controls ($p < 0.05$). There were no significant differences in terms of level of alanine aminotransferase or bilirubin in the two groups. In laparoscopic cholecystectomy AST, ALT, ALP, GGT, and total bilirubin levels were significantly increased at 24hours postoperative (p-value less than 0.05) which began to return to baseline levels after 72 hours. There was no significant postoperative change in the direct bilirubin levels. ***Conclusions****:* Gallbladder disease in women of Dhi Qar Governorate is mainly related to dyslipidemia and not baseline liver dysfunction. Laparoscopic cholecystectomy causes temporary and reversible rises in liver enzymes and no signs of long-term hepatocellular damage and biliary dysfunction.

Keywords: Gallbladder disease; Dyslipidemia; Liver function tests; Laparoscopic cholecystectomy.

1. INTRODUCTION

Gallstone disease (GSD) is one of the most prevalent diseases of the hepatobiliary system and still a significant morbidity cause of the gastrointestinal track globally. The recent estimates in the world suggest that about 6-10 percent of the adult population has gallstones, and there is a significant difference on the same between different geographical regions, and women have always been found to be more affected by it [1,2]. Despite the improvement in the effectiveness of diagnostic imaging and minimally invasive surgery, the overall weight of the gallbladder and biliary tract diseases is still growing, but most of them are due to the aging of the population and the increasing percentage of metabolic risk factors [2]. These tendencies emphasize the necessity of studying the biochemical and metabolic peculiarities of the gallbladder disease in the various population groups.

Clinically, the gallstone disease is characterized by a wide range of manifestations, such as both asymptomatic gallstones and biliary colic, acute calculus cholecystitis, choledocholithiasis, and pancreatitis associated with gallstones [3,4]. The world society of

emergency surgery, the Tokyo guidelines, and other international guidelines have all suggested that early laparoscopic cholecystectomy must be the final intervention in symptomatic gallbladder disease in patients at the right time [3,4]. Laparoscopic cholecystectomy is the preferred method of care because of its good safety profile, decreased postoperative pain and reduced hospitalization and decreased recurrence rates unlike the open or delayed methods of surgery [5]. However, the occurrence of perioperative biochemical alterations especially in tests of liver functioning is a common cause of clinical confusion.

The etiology of gallstone disease and in particular cholesterol gallstones is strongly associated with the lipid metabolic disturbances. The formation of cholesterol gallstones occurs as a result of the supersaturation of the bile with cholesterol and the nucleation and crystal formation of the bile under the influence of compromised gallbladder motility and anabiosis of the bile acids [6]. The intricate transporter systems, comprising ATP-binding cassades transporters (ABCG5 and ABCG8) are involved in hepatic cholesterol processing and biliary secretion and are essential in controlling the biliary cholesterol level [7]. There is dysregulation of these mechanisms coupled with metabolic risk factors which results in a lithogenic bile environment predisposing to the development of gallstones.

The dyslipidemia has been repeatedly suggested as a major metabolic correlate of gallstone disease. High total cholesterol, high levels of low-density lipoprotein cholesterol (LDL-C) and hypertriglyceridemia play a role and cause bile that is rich in cholesterol and predisposes one to stones [8]. The recent population-based research and meta-analyses have shown that gallstones have strong relationships with poor lipid profiles, especially in younger and middle-aged adults [8,9]. Significantly, lipid parameters are regularly assessed in medicine and are modifiable risk factors indicating that it might be possible to prevent and implement early intervention in individuals at risk.

The Epidemiology of gall stone disease is dominated by sex-related differences. The effect is more common in women, which is explained mostly by the hormonal factors on the composition of bile and the motility of the gallbladder. As the estrogen elevates the cholesterol secretion into the bile and progesterone decreases the gallbladder contractility, it leads to the bile remaining stagnant [10]. Such mechanisms are especially applicable in women at reproductive age where the gallstone disease is an oftentimes signaling factor that warrants elective surgery. Investigations of female populations that are relatively homogeneous might then be enlightening on disease specific alterations in metabolism and biochemistry and prevent confounding influences of sex hormones, chronic disease, or old age.

Liver tests (LFTs) are commonly employed in the diagnosis of patients with the suspected gallbladder disease but their interpretation may prove to be complicated. In simple gallstone disease, the initial values of alanine aminotransferase (ALT) and aspartate aminotransferase (AST) and bilirubin are usually normal, and significant increases are usually an indication of complications, including the blockage of the bile duct or cholangitis [5,11]. It is very important to distinguish between uncomplicated disease and more complicated hepatobiliary involvement because abnormal LFTs usually trigger further diagnostic scrutinies, such as magnetic resonance cholangiopancreatography or endoscopic retrograde cholangiopancreatography.

Other than biochemical trends of disease, laparoscopic cholecystectomy itself has been linked to short-term postoperative changes in liver enzymes. Short-term increases in AST, ALT, alkaline phosphatase (ALP), gamma-glutamyl transferase (GGT), and bilirubin have been recorded in a number of studies in the immediate postoperative period and have generally resolved without any intervention in several days [12,13]. The best-known explanation is the impact of carbon dioxide pneumoperitoneum that may cause hepatic blood flow to temporarily decrease and cause mild and reversible stress of the hepatocellular type [12]. It is important to note this anticipated pattern of postoperative progress to prevent unnecessary inquiries or wrong interpretation of benign biochemical changes as postoperative complications.

Even though the literature on the technological disease has been vast in the world, some areas of the world have limited information on the disease, such as Iraq. Evidence of the regional studies indicates a significant presence of the gallbladder disease with a distinct female predominance, yet little has been done in terms of analyzing the lipid compositions and the alterations in the liver functions after the operations [14,15]. In Dhi Qar Governorate, where the metabolic health might be affected by the demographic and lifestyle changes, the area-specific data is required in order to make evidence-based clinical choices. In addition, by targeting women with no chronic systemic illness or cancer, in turn, it becomes possible to evaluate biochemical changes, which can be ascribed to gallbladder disease and surgical operation, but not comorbid conditions, more specifically.

In line with that, the current study was aimed at handling two complementary objectives. First, it endeavored to compare levels of lipid profiles and baseline liver functions tests in women with gallbladder disease and their healthy controls in Dhi Qar Governorate. Second, it aimed at determining the short-term postoperative liver enzyme changes after laparoscopic cholecystectomy. Through the combination of a case-control analysis and a prospective perioperative

study, this research offers a holistic analysis of metabolic and hepatic biochemical profiles of gallbladder disease, and its surgery in a clearly defined female cohort.

2. METHODS

Design and Population of the study: The study had two components; case and control study, followed by a prospective observational part. One hundred people were enrolled with 100 female patients with gallbladder disease. All the patients were married; their periods were regular and were aged between 30 and 45 years. All the participants had no history of chronic systemic diseases, malignancy, and endocrine disorders.

A control group of 100 seemingly healthy people with the range of ages and having no history of gallbladder or hepatobiliary disease was included in comparison.

To examine the changes in perioperative liver function tests, 100 patients undergoing elective laparoscopic cholecystectomy were followed to help in the prospective analysis.

Inclusion and Exclusion Criteria Inclusion criteria were adult patients with known gallbladder disease who fell within the stipulated age and clinical parameters. Exclusions were; the presence of chronic liver disease, diabetes mellitus, cardiovascular disease, renal impairment, malignancy, pregnant state, irregular menstrual cycle, or use of lipid-lowering or hepatotoxic medications.

Data Collection and Lab Analysis: Venous blood samples had been taken following an overnight fast. The levels of alanine aminotransferase (ALT), aspartate aminotransferase (AST), alkaline phosphatase (ALP), gamma-glutamyl transferase (GGT), total and direct bilirubin, total cholesterol, triglycerides, low-density lipoprotein cholesterol (LDL-C), and high-density lipoprotein cholesterol (HDL-C) were assayed in a certified clinical laboratory by using standard automated enzymatic protocols. Blood samples were taken preoperative, 24 and 72 hours postoperative in patients who underwent laparoscopic cholecystectomy.

Statistical Analysis:

There was statistical analysis of data by use of standard statistical software. The continuous variables were in the form of mean and standard deviation (SD). The independent samples t-test was used to compare patients and controls. Biochemical parameters that were tested prior to and subsequent to surgery were compared using paired t-test. The statistically significant level was taken to be two-tailed p-value less than 0.05.

Ethical Considerations: The research guideline has been carried out in line with the Declaration of Helsinki. All subjects gave informed consent in writing before enrolling in the study.

3. RESULTS

In the current paper, the patients with a gallbladder disease showed a significant change in lipid metabolism as compared to healthy controls, whereas liver transaminases and bilirubin were not significantly different between them.

Table 1: Comparison of Liver Function Tests and Lipid Profile Between Patients with Gallbladder Disease and Healthy Controls

Parameter	Patients (n = 100) Mean ± SD	Controls (n = 100) Mean ± SD	p-value
ALT (U/L)	28.04 ± 24.92	26.64 ± 25.67	0.564
Total Bilirubin (µmol/L)	13.91 ± 5.69	13.69 ± 5.41	0.659
Total Cholesterol (mmol/L)	5.19 ± 1.00	4.61 ± 0.95	0.001
Triglycerides (mmol/L)	1.92 ± 1.86	1.58 ± 1.44	<0.001
LDL-C (mmol/L)	3.15 ± 0.86	2.95 ± 0.82	<0.001
HDL-C (mmol/L)	1.37 ± 0.36	1.42 ± 0.37	0.020

Statistical analysis: Independent samples *t*-test
Significance level: $p < 0.05$

Table 2: Changes in Liver Function Tests Before and After Laparoscopic Cholecystectomy

Parameter	Preoperative	24 h Postoperative	72 h Postoperative	p-value
Total Bilirubin (mg/dL)	0.45± 0.26	0.84 ± 0.43	0.51 ± 0.25	<0.001
Direct Bilirubin (mg/dL)	0.17 ± 0.09	0.23 ± 0.21	0.16 ± 0.08	0.670
AST (U/L)	28.89 ± 15.58	41.86 ± 21.67	31.77 ± 14.38	<0.001
ALT (U/L)	31.59 ± 17.79	46.59 ± 20.62	32.41 ± 16.44	<0.001
ALP (U/L)	102.38 ± 33.79	113.04 ± 41.34	94.82 ± 29.32	<0.001
GGT (U/L)	36.43 ± 24.75	49.21 ± 36.91	41.33 ± 21.85	<0.001

Significance level: $p < 0.05$

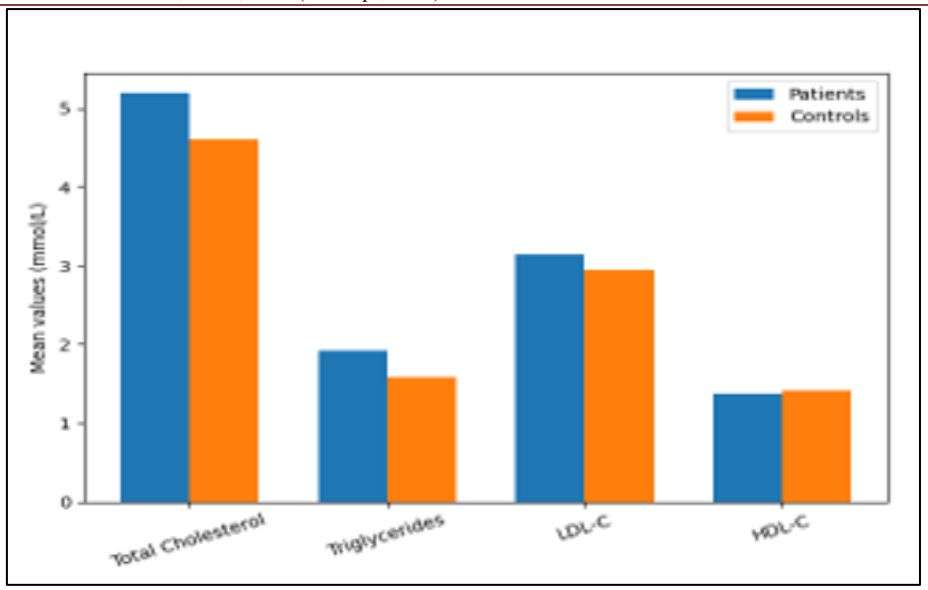

Figure 1: Lipid Profile Comparison Between Patients with Gallbladder Disease and Healthy Controls

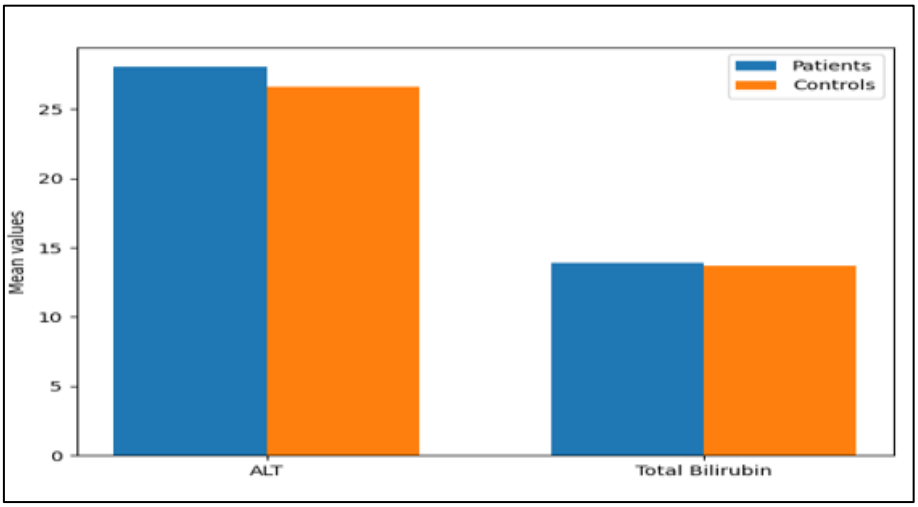

Figure 2: Liver Function Tests in Patients vs Controls

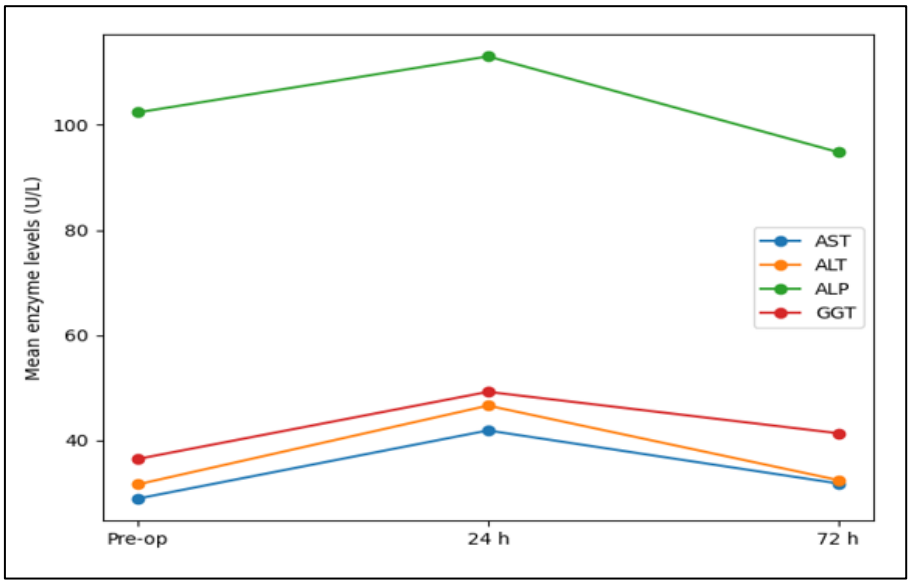

Figure 3: Temporal Changes in Liver Enzymes Following Laparoscopic Cholecystectomy

Table 1 demonstrated and Figure 1 illustrated that patients recorded very high levels of serum total cholesterol, low-density lipoprotein cholesterol (LDL-C), and triglyceride, and very low levels of high-density lipoprotein cholesterol (HDL-C) as compared to controls ($p < 0.05$). The results confirm or confirm the existing correlation between the dyslipidemia and the gallbladder disease, indicating that the changes in lipid profiles could be the cause of the development of gallstones due to the excessive saturation of bile with cholesterol.

However, in comparison, there were no statistically significant changes in alanine aminotransferase (ALT) or total bilirubin between the patients and controls (Table 1, Figure 2), and this implies that overt hepatocellular injury or clinically significant biliary obstruction was not present in this cohort. This observation is in line with the study of patients who do not have chronic liver disease or advanced hepatobiliary complications.

The future study showed that there was a specific temporal pattern of liver enzyme changes after laparoscopic cholecystectomy. At 24 hours postoperative, there was a significant temporary increase in the level of AST, ALT, ALP, and GGT ($p < 0.05$), and then the values returned to baseline at 72 hours (Table 2 and Figure 3). The total bilirubin had an equivalent temporary elevation but direct bilirubin was not changed, which indicates that the biliary excretory function is preserved. These postoperative biochemical events can probably be explained by temporary hepatic perfusion changes and pneumoperitoneum-related events during laparoscopic surgery and not hepatocellular destruction. The restoration of normal levels of enzymes in 72 hours also contributes to the harmless and reversible character of these alterations.

4. DISCUSSION

Gallstone disease has been one of the most common hepatobiliary diseases whose clinical and economic outcomes are very high in the world especially in middle-aged women. Recent worldwide syntheses affirm that gallstones influence a large percentage of adult people and that female gender and metabolic danger aspects play a significant role in noted geographic and demographic disparities in prevalence and presentation [16,17]. It is on this backdrop that the present research offers region-specific data on Dhi Qar Governorate that illustrates the presence of two complementary patterns, (1) a definite relationship between gallbladder disease and unfavorable lipid profile features in otherwise healthy women, and (2) a predictable, temporary postoperative increase in the levels of liver enzymes and total bilirubin in the conditions of laparoscopic cholecystectomy which improve spontaneously within 72 hours. Exploration of lipid profile results in gallbladder disease.

The case-control element exhibited a much greater number of total cholesterols, LDL-C and triglycerides and a much lessening number of HDL-C in patients than in controls (Table 1), which is reflected in Figure 1 too. The results are in line with the modern-day mechanistic and epidemiological modelings, which are progressively inclined to define gallstone disease, in particular cholesterol gallstones, as a symptom of metabolic dysfunction instead of a specific biliary condition [18,19]. Adverse lipid fractions (greater total cholesterol, LDL-C, triglycerides and reduced HDL-C) are commonly linked to the risk of gallstones in large scales of observational data and dose-response meta-analytic data, but with varying effect sizes depending on the population, outcome measure, and confounding control [20,21]. Our findings are in line with these general results since they indicate a clinically consistent dyslipidemic phenotype of gallbladder disease in a group of female participants whose selection was done to minimize the impact of key confounding factors (no chronic systemic disease, no malignancy, regular menstrual cycles). t a biological level, the lipid abnormalities observed are reasonable sources of cholesterol supersaturation of bile, a key stage in cholesterol gallstone formation. Modern reviews underline that augmented secretion of hepatic cholesterol through bile, gallbladder motor defects and change in intestinal factors all facilitate lithogenesis [18,19]. Notably, the transporter systems (such as ABCG5/ABCG8) and the systemic lipid dynamics regulate the hepatic cholesterol transportation and biliary cholesterol release; in case of disruption to their operation, the biliary cholesterol content and crystallization predisposition may rise [22,23]. Our lipid results are consistent with our current knowledge of mechanisms, and we interpret this as indicating that dyslipidemia is not simply a coincidental finding but may be an upstream metabolic environment that facilitates the formation of gallstones.

In addition to traditional lipid fractions, more more recent findings have been done on lipid-derived composite indices and metabolomic signatures as possible risk factors of gallstones. For instance, studies based on NHANES data have discussed ratios of atherogenic balance (e.g. non-HDL-C/HDL-C-based ratios) and show significant correlations with a history of gallstones among younger adults [24]. Also, future metabolomic studies have found metabolic signatures in the circulation that are antecedent to incident gallstone disease, and such findings support the hypothesis that gallstones are woven into systemic metabolic changes and not solely local biliary functions [25]. Although the use of advanced lipid indices/metabolomics was not part of our study, the pattern of rise in atherogenic lipids and decrease in HDL-C is directionally consistent with these modern methods, indicating that the future extension of our study in Dhi Qar may involve the use of risk indices or observed metabolite panels to better predict outcomes.However, unlike the lipid results, There were

no significant differences in baseline ALT or total bilirubin between cases and controls (Table 1; Figure 2). This clinical presentation is similar to what is expected of uncomplicated gallbladder disease, in that it often does not last long and there is no permanent hepatocellular damage or obvious cholestasis. Global clinical reviews emphasize that abnormal LFTs can provide the most relevant information in the presence of complications, including common bile duct stones, cholangitis, or severe biliary obstruction; otherwise, LFTs can have normal values or show only slight and diffuse changes [20,21]. Thus, the lack of the difference in the baseline of the ALT and bilirubin in our cohort is probably due to the careful consideration of the relatively uncomplicated cases and to the exclusion of the comorbid chronic liver disease and other systemic pathologies that may increase transaminases.

In practical terms, the finding is applicable to the diagnostic processes. Misinterpretation of mild changes in LFT can result in the additional imaging and invasive tests that are not necessary, whereas normal LFTs do not rule out the presence of symptomatic gallbladder disease. We find that our results align with clinical practice whereby biochemical tests are used to interpret along with images and pattern of symptoms and not on their own discriminating gallbladder pathology, which is recommended in international practice and evidence-based practice.[20,2125,26]

The prospective component showed large transient postoperative increases in AST, ALT, ALP, GGT, and total bilirubin at 24 hours at the expense of a decrease to the baseline at 72 hours (Table 2; Figure 3). Direct bilirubin did not alter significantly. This time curve is very similar to those patterns presented in a recent scoping review with a large collection of postoperative LFT literature that has found that ALT/AST increases are common during 24-48 hours and that they usually subside over the following days, whereas cholestasis enzymes and bilirubin will increase in proportion of fewer patients and they are generally mild [29,30]. The correspondence of our results with this modern synthesis reinforces the belief that the related postoperative biochemical changes are anticipated physiological changes instead of indications of clinically significant hepatobiliary injury in most patients.

There are a number of mechanisms that are probably involved. Pneumoperitoneum, which is a critical constituent of laparoscopic surgery, elevates intra-abdominal pressure, which may decrease portal venous flow and hepatic microcirculation with resultant background hepatocellular stress and enzyme leakage that is transient. The enzyme levels can be further altered by the use of anesthetic regimens, positioning of the patient, and intermittent changes in hepatic perfusion in the perioperative period, especially in the early postoperative period [30-32]. Notably, the 72-hour faster rate of our cohort increase alongside the absence of a significant increase in the direct bilirubin (Table 2) suggests retained biliary excretory activity and can be used against obstructive pathology as a dominant force. These results suggest the standpoint promoted in a contemporary literature review of the surgery: postoperative LFTs must be interpreted, considering the symptomatology, imaging, and the extent/prolongation of abnormalities. Mild-to-moderate and self-limited elevations usually have little pathologic impact; but significant or progressive alterations, especially when in association with jaundice, fever, abdominal pain, or a suspicion of bile leakage, are cause to consider retained common bile duct stones or iatrogenic bile duct injury [20,25,26].

One of the characteristics of the current study is the limitation to women aged between 30 and 45 years old without chronic systemic disease or malignancy with regular menstrual cycles. This type of design minimizes confounding because of metabolic comorbid conditions (e.g., diabetes, chronic kidney disease), chronic inflammatory conditions, and cancer-related dysmetabolism. It also gives a better insight into the biology of the gallbladder disease in a reproductive age of the female population, where hormonal factors can be playing a role in the increase of the risk of gallstones by changing the biliary cholesterol release and gallbladder motility [18,19]. Although we have not directly measured sex hormones, internal validity is enhanced when menstrual regularity is controlled and other major comorbidities are excluded when we compare biochemicals with disease processes and the interpretation of the lipid signal (Table 1; Figure 1) is that the lipid signal observed is associated with disease processes and not the artifact of comorbidity.

6. CONCLUSIONS

In This study concluded that the gallbladder disease in women between 30-45 years of age in the Dhi Qar Governorate is not related to the minimum liver dysfunction but rather to dyslipidemia, including increased total cholesterol, LDL, and triglycerides with lower HDL. There were no notable variations in the number of alanine aminotransferase and total bilirubin between the patients and the controls, which shows that no overt signs of hepatocellular damage were present in the uncomplicated cases. Transient postoperative liver enzymes and bilirubin that returned to normal levels in 72 hours were physiological surgical responses to laparoscopic cholecystectomy. These results highlight the importance of metabolic study in the gallbladder disease and validates the biochemical safety of laparoscopic cholecystectomy in properly selected patients.

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