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Age and Lipid Profile: Key Predictors of Gallstone Risks

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ABSTRACT

Background: *Gall stone diseases occurrence among Iraqi patients is high due to ethnic background & dietary habit. Because of ethnic foundation & dietary pattern, Cholelithiasis propagation is very high in Iraqi patients.*

Aims: *to show how age and serum lipid profile affect the formation of gallstone disease in Iraqi patients.*

Patients and Methods: *The study includes 90 patients; 60 female patients, 30 male patients with gallstone disease. Patient's age, Total Cholesterol, Triglycerides, Lipoproteins (LDL, VLDL, and HDL) were collected & studied.*

Result: *The study compared demographic characteristics and lipid profiles between patients with gallstones and controls without gallstones. Mean age and sex distribution were similar between two groups, but family history of gallstones was more common in patients. Regarding lipid profiles, patients had significantly higher levels of triglycerides, total cholesterol, and low density lipoprotein, while controls had higher levels of high-density lipoprotein. The Total Cholesterol/High Density Lipoprotein ratio was significantly elevated in patients compared to controls. This ratio showed good predictive value for identifying high risk fibrosis, with a cutoff value of 3.68, sensitivity of 80%, and specificity of 98.5%.*

Conclusion: *Gallstone formation involves elevated serum lipids, especially cholesterol and triglycerides. While females are more prone to gallstones, the exact link between lipid levels and gender is uncertain. Different populations show varied gallstone prevalence due to factors like race and diet. It is essential to comprehend these complexities in order to establish preventative and treatment plans that are effective.*

Keywords: *Gall stones, serum lipids profile, Total Cholesterol, Triglyceride, Low-Density Lipoprotein, High-Density Lipoprotein*

Abbreviations

GS: Gallstones

TG: Triglycerides

TC: Total Cholesterol

LDL: Low Density Lipoprotein

HDL: High Density Lipoprotein

INTRODUCTION

Gall stone diseases occurrence among Iraqi patients is high due to ethnic background & dietary habit. Because of ethnic foundation & dietary pattern, Cholelithiasis propagation is very high in Iraqi patients. Alterations in the metabolism of lipid leading to raise the cholesterol level comparative to different lipids emitted from the liver into bile is considered the fundamental events in gallstone pathogenesis. An irregularity in the metabolism of lipid might emerge from a series of different factors like excess weight, overabundance dietary fat/cholesterol, diabetes and hereditary variables. The relationship of cholesterol super immersion of bile with cholesterol Cholelithiasis cleared the path to a physico-chemical reason to the development of Cholelithiasis. It nonetheless, before long turned out to be evident that different variables involving nucleation of cholesterol crystals which eventually bind with mucin, hypomotility of the bladder assumed similarly significant parts in the development of gallstone. The most prevalent kind of gallbladder illness, known as gallstones or cholelithiasis, affects 10% of people in the USA. [1]. Cholesterol, bilirubin and calcium is the major constituents of gallstone [2]. Triglycerides, protein, fatty acids, and polysaccharide are considered the other constituents of gallstone [3]. Gallstones are glasslike structures shaped by growth or solidification (collection, adherence of particles) of abnormal &/or normal constituents of bile in three steps process; supersaturation, nucleation and accumulation [4]. Alteration in lipid metabolism is presently generally acknowledged as the essential phenomenon in cholesterol gallstones pathogenesis. Due to this alteration, there is an overall increase in the level of cholesterol in comparison with different lipids emitted by the liver into the bile [5]. Changes in the lipid digestion might emerge because of a mix of different factors like estrogen treatment, maturing [6], overweight, hypertriglyceridemia, and patients with insulin resistance [7], diabetes, obese patient (obesity), abundance fat/cholesterol diet, and hereditary causes [5]. Female are two times as reasonable as male to foster gallstones; multiple pregnancies and obesity are believed to be the main causes of the higher pervasiveness of gallstones in female patients [8]. Concentrations of the major lipid components bile acids, cholesterol, and phospholipids will determine the lithogenicity of the bile [7]. Proportional increment in cholesterol concentration in bile, &/or supersaturation, prompted the development of gallstones [6], additionally any alteration in the metabolism of bile acid &/or in the function of gallbladder are crucial factors in cholelithiasis pathogenesis [7]. Leukocytosis, advanced age, and previous history of coronary artery disease have all been linked in some prior research to an increased risk of gangrenous cholecystitis [9]. Gallstones may trigger hemorrhagic cholecystitis with hemoperitoneum and low hemoglobin concentration, a medical condition that affects women more frequently (40%) than men (36%) [4], another study [10] demonstrated that thrombocytopenia and a drop in blood hemoglobin were both brought on by gallstone escape resulting from hemorrhagic cholecystitis perforation. It has also been demonstrated that people with hemoglobin C disorders may develop pigment gallstones, an uncommon kind of gallstone, as a result of ongoing hemolysis [11]. In overall, regular hematological and liver function tests are required in preoperative assessment of simple symptomatic cholelithiasis, aside from the measurement of lipid profile for prognosis of patient with gallstones [12]. This is because cholelithiasis can cause severe liver damage and a defect in its enzymes [13]. Increased leukocyte counts and liver enzymes can often be the result of damage to liver cells caused by inflammation and infection [14]. This may be generated by gallstones moving into the common bile duct and liver, producing inflammation. The purpose of this study was to figure out whether the development of gallstones could alter the serum lipid profile and certain hematological markers.

PATIENTS AND METHODS

Patients

This study examined total cholesterol, triglycerides, and lipoproteins (LDL, VLDL, and HDL) in the sera of ninety patients who were recently diagnosed with gallstones in a surgical unit of the Al-Yarmouk Teaching Medical Hospital in Baghdad, Iraq. The patients fluctuated in ages from twenty to seventy-three, were of normal weight, did not smoke, and did not receive any treatment. Each patient had a venous blood sample of five milliliters taken for the fasting period. When the samples were ready for analysis, they were right away placed into plastic test tubes, centrifuged for fifteen minutes at 3000 rpm, separated the serum, and stored at -85°C. Using a standard kit (Syrbio, France), the serum cholesterol content was determined based on the

enzymatic conversion of cholesterol to quinoneimine pigmentation. The absorbance of the pigment was subsequently measured at a wave length of 500 nm using a UV/VIS Spectrophotometer (Philips, Pye Unicam SP800). Using a standard kit (Syrbio, France), the amount of serum triglycerides was assessed. This method relies on the enzymatic hydrolysis of triglycerides using lipases. The absorption of the triglycerides was then measured at 520 nm using a UV/VIS Spectrophotometer (Philips, Pye Unicam SP800). The measurements of LDL and HDL cholesterol were done in accordance with Sewerynek (2000).

DIAGNOSTIC METHODS

All patients are assessed by:

a) Suspected patients with gallstone disease are evaluated by ultrasound imaging study & liver function tests. (25)

b) If the common bile duct stones are not detected by ultrasound imaging study, then Magnetic resonance cholangiopancreatography is used instead. (23)

c) If the diagnosis is not made by magnetic resonance cholangiopancreatography, endoscopic ultrasound is used to confirm the diagnosis. (20)

Statistical Analysis

The mean ± standard deviation was used to describe the continuous variables having a normal distribution. Percentages were used for representing categorical variables. Using the Student t-test, comparisons between continuous variables were made. The Chi square test was utilized to compare categorical variables. We used the receiver operating characteristic (ROC) curve to find the TG/HDL cut-off points. The areas under the curve, specificity, and sensitivity were computed. Every data set was examined using The data was statistically processed using IBM Corp.'s SPSS for Windows, version 25.0, located in Armonk, New York, USA.

RESULTS

Association of Demographic Characteristics with Gallstone Formation

The mean age of patients with GS was 45.73 ± 10.53 years which was very close to that of controls with no significant difference. Similarly, the two groups were comparable in sex distribution were female account for about two-third of the included subjects in both groups with no significant difference. In contrast, family history of GS was more common among patients 43.33% than controls 23.33% with a highly significant difference (Table 1).

Table 1: Association of demographic characteristics with gallstone formation

Variables	Patients (n= 90)	Controls (n=90)	*P*-value
Age, years Mean ± SD Range	 45.73 ± 10.53 20-73	 47.37 ± 12.52 22-73	 0.345
Sex Male Female	 30(33.33%) 60(66.67%)	 32(35.56%) 58(64.44%)	 0.754
Family history No Yes	 51(56.67%) 39(43.33%)	 69(76.67%) 21(23.33%)	 <0.001

Association of Lipid Profile with Gallstone Formation

Generally, the mean serum level of TG, TC and LDL were significantly higher in patients than controls with significant differences. In contrast, HDL was higher in controls than patients with a highly significant difference. Categorization of lipid profile components according to normal and abnormal values reveled that elevated serum level of TG, TC and LDL were more frequent among patients 44.44%, 40% and 31.11%,

respectively than controls 21.11%, 29.89% and 24.44%, respectively with significant differences. In contrast, reduced HDL was more common in patients than controls 31.11% vs. 20% although the difference was not significant. The mean value of derived TG/HDL ratio was 5.1 ± 1.94 which was much higher than controls 3.11 ± 0.65 with a highly significant difference (Table 2).

Table 2: Association of lipid profile with gallstone formation

Variables	Patients (n= 90)	Controls (n=90)	*P*-value
Triglycerides, mg/dl			
Mean ± SD	177.95 ± 96.7	151.74 ± 63.94	0.033
Range	70-449	88-412	
Normal	59(65.56%)	71(78.89%)	0.046
Elevated	31(34.44%)	19(21.11%)	
Total cholesterol, mg/dl			
Mean ± SD	192.71 ± 62.67	175.75 ± 48.73	0.044
Range	100-422	107-277	
Normal	50(55.56%)	64(71.11%)	0.030
Elevated	40(44.44%)	26(29.89%)	
LDL, mg/dl			
Mean ± SD	116.82 ± 43.27	104.64 ± 37.47	0.045
Range	67-229	43-188	
Normal	54(60%)	68(75.56%)	0.026
Elevated	36(40%)	22(24.44%)	
HDL, mg/dl			
Mean ± SD	38.13 ± 6.64	44.43 ± 8.2	<0.001
Range	26-57	28-83	
Normal	62(68.89%)	72(80%)	0.087
Reduced	28(31.11%)	18(20%)	
TG/HDL ratio			
Mean ± SD	5.1 ± 1.94	3.11 ± 0.65	<0.001
Range	1.89-13.3	1.71-5.36	

Predictive Value of TG/HDL Ratio

The predictive usefulness of TG/HDL in foretelling high-risk fibrosis was assessed using a receiver operating characteristic (ROC) curve. AUC (area under the curve): 0.862, 95% confidence interval (CI): 0.836-0.919, p<0.001. 3.68 was the best cut of value. The test's sensitivity and specificity were 80% and 985%, respectively, at this cutoff value (Figure 1).

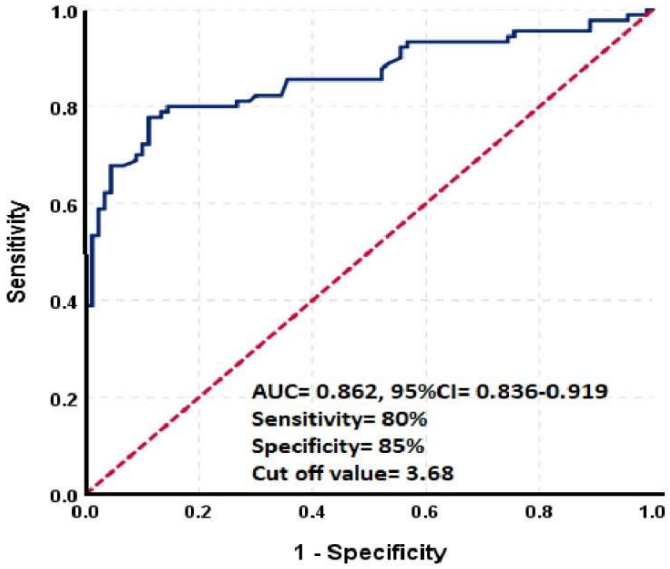

Figure 1: Receiver operating characteristic curve for TG/HDL in anticipating gallstone

DISCUSSION

Elevated levels of TG, TC, and LDL in patients with gallstones are consistent with findings from patients in Pakistan [15]. A different study found that the precipitation of cholesterol in bile, a necessary condition for the formation of gallstones, is caused by free cholesterol increasing steroid synthesis, which in turn reduces the generation of bile acids [4]. Quantitative analysis of Libyan patients' blood with gallstones demonstrated a considerable rise in cholesterol levels, according to another study [1]. According to additional research, individuals with heart disease who underwent heart surgery had significant rises in triglycerides, cholesterol-LDL, and overall free cholesterol following the procedure [16]. In Spanish, some researchers observed a positive correlation between serum triglycerides and gallstones [15], while other researchers found no such correlation [13]. Contrary other research, the serum levels of total cholesterol, LDL, and HDL in Libyan cholelithiasis patients showed a highly significant increase for both male and female subjects [5]. However, our findings indicated that the group of patients under study had lower HDL cholesterol levels. Gender determines the prevalence of GS, with females having a higher incidence [17]. To determine the root cause of this gender disparity, a number of factors have been considered. Nonetheless, an important outcome is suggested by the possibility that serum lipids contribute to the higher rate of GS in females. Current epidemiological research indicates that GSD is more common in women than in men in Western civilization, with estrogen thought to have a significant role in this [18]. It is still debatable if gender is a risk factor for cholelithiasis. Asian research has not yet shown a correlation between the occurrence of gallstones and gender, despite the majority of Western studies demonstrating that women are more likely than men to acquire cholelithiasis [19, 20, 21]. A different study discovered that although women over 50 had a greater incidence of cholelithiasis than men did, males had a higher incidence than women under 50[22]. One risk factor for women who have cholelithiasis is menopause [24]. Furthermore, women's cholelithiasis is less prevalent in Asia due to the prevalence of pigmented stones [23]. Therefore, the incidence of GSD among Asian men is greater due to race or dietary habits, while the majority of women with GSD are premenopausal and under 50.

CONCLUSION

The discussion surrounding the development of gallstones and its correlation with serum lipid levels, gender disparities, and epidemiological variances provides significant understanding of the complex characteristics of this illness. First off, a variety of studies have demonstrated that patients with gallstones have an elevated total lipid profile, which emphasizes the role lipid metabolism plays in the etiology of gallstones. Particularly, the rise in triglycerides, LDL, and free cholesterol points to a possible role for dyslipidemia in encouraging the production of gallstones and cholesterol crystallization. Second, it is a well-known fact that there is a gender

difference in the frequency of gallstones, with females showing a higher prevalence. Although the impact of estrogen is well known, the gender skew is also caused by genetic predisposition, gallbladder motility, and intrahepatic cholestasis. However, as indicated by the reviewed study's lack of a definite link, the precise interaction among gender and serum lipids in gallstone development needs to be investigated more thoroughly. Lastly, the epidemiological differences in the occurrence of gallstones among various communities demonstrate the impact of age, race, and dietary practices. Studies conducted in the West often show a greater prevalence in women; however Asian cultures show different patterns: colored stones are more prevalent and gender differences are less noticeable. To sum up, the process of gallstone formation is complex and involves multiple elements, including hormone fluctuations, lipid metabolism, genetic predisposition, and triggers from the environment. A thorough knowledge of gallstone etiology and the creation of focused preventive and treatment strategies require more study addressing the complex interactions between these variables.

REFERENCE

(1) Rasheed RA. Lipid profile and hematological changes in gallstone patients. Science Journal of University of Zakho. 2014 Jun 30; 2(1): 49-53.

(2) Johnston DE, Kaplan MM. Pathogenesis and treatment of gallstones. New England Journal of Medicine. 1993 Feb 11; 328(6): 412-21.

(3) Selvaraju R, Raman G, Narayanaswamy R. Change in serum trace elements concentration before and after removal of gallbladder with gallstone. The internet journal of gastroenterology. 2009; 8(1): 1-6.

(4) Channa NA, Shaikh HR, Khand FD, Bhanger MI, Laghari MH. Association of gallstone disease risk with serum level of alkaline phosphatase. JLUMHS 2005; 4(1): 18-22

(5) Rao PJ, Jarari A, El-Awami H, Patil TN, El-Saiety SO. Lipid profile in bile and serum of cholelithiasis patients-A comparative study. Journal of basic medical and Allied sciences. 2012; 1(2): 27-39.

(6) Cuevas A, Miquel JF, Reyes MS, Zanlungo S, Nervi F. Diet as a risk factor for cholesterol gallstone disease. Journal of the American College of Nutrition. 2004 Jun 1; 23(3): 187-96.

(7) Smelt AH. Triglycerides and gallstone formation. Clinica chimica acta. 2010 Nov 11; 411(21-22): 1625-31.

(8) Devrajani BR, Muhammad AT, Shah SZ, Devrajani T, Das T. Frequency of gallstones in patients with diabetes mellitus (a hospital based multidisciplinary study). Medical channel. 2010; 16(2): 230-2.

(9) Fagan SP, Awad SS, Rahwan K, Hira K, Aoki N, Itani KM, Berger DH. Prognostic factors for the development of gangrenous cholecystitis. The American journal of surgery. 2003 Nov 1; 186(5): 481-5.

(10) Kim YC, Park MS, Chung YE, Lim JS, Kim MJ, Kim KW. Gallstone spillage caused by spontaneously perforated hemorrhagic cholecystitis. World journal of gastroenterology: WJG. 2007 Nov 11; 13(41): 5525.

(11) Carter SM, Besa EC. Hemoglobin C disease. Medscape reference. 2012: 118-23.

(12) Habib L, Mirza MR, Ali Channa M, Wasty WH. Role of liver function tests in symptomatic cholelithiasis. J Ayub Med Coll Abbottabad. 2009 Jun 1; 21(2): 117-9.

(13) Olokoba AB, Bojuwoye BJ, Katibi IA, Salami AK, Olokoba LB, Braimoh KT, Inikori AK. The effect of type 2 diabetes mellitus on fasting gallbladder volume. African Scientist. 2021 Jun 22; 7(3).

(14) Pereira-Lima JC, Jakobs R, Busnello JV, Benz C, Blaya C, Riemann JF. The role of serum liver enzymes in the diagnosis of choledocholithiasis. Hepato-gastroenterology. 2000 Nov 1; 47(36): 1522-5.

(15) Channa NA. GALLSTONE DISEASE: A REVIEW: Gallstone Disease. Pakistan Armed Forces Medical Journal. 2008 Jun 30; 58(2): 197-208.

(16) Shiina Y, Toyoda T, Kawasoe Y, Tateno S, Shirai T, Matsuo K, Mizuno Y, Ai T, Niwa K. The prevalence and risk factors for cholelithiasis and asymptomatic gallstones in adults with congenital heart disease. International journal of cardiology. 2011 Oct 20; 152(2): 171-6.

(17) Shinchi K, Kong S, Honjo S, Imanishi K, Hirohata T. Serum lipids and gallstone disease a study of self-defense officials in Japan. Annals of epidemiology. 1993 Nov 1; 3(6): 614-8.

(18) Sieron D, Czerny B, Sieron-Stoltny K, Karasiewicz M, Bogacz A, Seremak-Mrozikiewicz A, et al. The effect of chronic estrogen application on bile and gallstone composition in women with cholelithiasis. Minerva endocrinological. 2014 Nov 21; 41(1): 19-27.

(19) Cariati A. Gallstone classification in western countries. Indian Journal of Surgery. 2015 Dec; 77(Suppl 2): 376-80.

(20) Chen YC, Chiou C, Lin MN, Lin CL. The prevalence and risk factors for gallstone disease in Taiwanese vegetarians. PloS one. 2014 Dec 18; 9(12): e115145.

(21) Lai SW, Muo CH, Liao KF, Sung FC, Chen PC. Risk of acute pancreatitis in type 2 diabetes and risk reduction on anti-diabetic drugs: a population-based cohort study in Taiwan. Official journal of the American College of Gastroenterology. ACG. 2011 Sep 1; 106(9): 1697-704.

(22) Liu CM, Tung TH, Chou P, Chen VT, Hsu CT, Chien WS, Lin YT, Lu HF, Shih HC, Liu JH. Clinical correlation of gallstone disease in a Chinese population in Taiwan: experience at Cheng Hsin General Hospital. World journal of gastroenterology: WJG. 2006 Feb 2; 12(8): 1281.

(23) Stinton LM, Shaffer EA. Epidemiology of gallbladder disease: cholelithiasis and cancer. Gut and liver. 2012 Apr; 6(2): 172.

(24) Hung SC, Liao KF, Lai SW, Li CI, Chen WC. Risk factors associated with symptomatic cholelithiasis in Taiwan: a population-based study. BMC gastroenterology. 2011 Dec; 11: 1-7.