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C-Reactive Protein, Lipid Profile and Body Mass Index in Patients of Liver Cirrhosis

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Abstract

Background: Liver cirrhosis leads to the abnormalities in liver function. **Objective:** This study aimed to determine the C-reactive protein (CRP) and lipid profile in cirrhotic patients as well as their correlation with patients age and body mass index. **Methodology:** This case- control study was conducted in the Chittagong Medical College Hospital and People's Hospital Limited, Chattogram from October 2017 to March 2018 for a period of six months. Venous blood was collected from 25 patients and 25 controls after 8 hours overnight fasting. Inflammatory marker (CRP) and Serum lipid status were recorded for each participant. **Results:** The mean serum C-reactive protein; total cholesterol; Triglycerides; High Density Lipoprotein and Low Density Lipoprotein level were 2.448 ± 1.174; 132.228 ± 15.352; 100.228 ± 20.564 mg/dl; 53.081 ± 9.994 mg/dl and 59.108 ± 18.634 mg/dl in cirrhotic patients. CRP value was significantly higher in patients compared to healthy individuals ($p < 0.05$). The extent of decreasing lipid profile (except HDL) was also significantly related to the progress in cirrhosis ($p < 0.05$). The positive correlation of age and BMI of patients were associated with CRP and various lipid variables. **Conclusion:** The higher CRP value and extent of decreasing lipid profile (except HDL) in patients may serve as a baseline for further studies that required to determine the predictive values of lipid profiles as a means to estimate the extent of liver damage in cirrhotic patients. [*Bangladesh Journal of Infectious Diseases, June 2021;8(1):27-31]*

Keywords: Evaluation; cirrhotic patients; inflammatory marker; C-reactive protein; lipid profiles; Bangladesh

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Introduction

Liver is the vital organ for the metabolism of protein, fat, and carbohydrate[1]. Liver cirrhosis results from different types of liver injury resulting to necropinflammation and fibrosis. Histologically, it is characterized by diffuse nodular regeneration circumscribed by dense fibrotic septa with subsequent collapse of liver structures leading to the pronounced distortion of vascular architecture in the liver[2]. The main causes of cirrhosis include hepatitis B and C viruses, overuse of alcohol, and nonalcoholic liver disease[3]. The exact prevalence of cirrhosis is unknown, owing to symptom development later in the disease process. The CDC reports that, in 2018, 12.8 deaths out of every 100,000 in the U.S. were attributed to chronic liver disease and cirrhosis[3]. Cirrhosis is most common in men ages 20 to 59 year, at the age of productivity.

Lipids are essential component of biological membranes, free molecules and metabolic regulators that regulate cellular function and homeostasis[4]. Liver contributes both in exogenous and endogenous cycles of lipid metabolism and transport of lipids through plasma. Dyslipidaemia observed in chronic liver disease differs from that found in most of the other causes of secondary dyslipidaemias because circulating lipoproteins are not only present in abnormal amount but they also frequently have abnormal composition, electrophoretic mobility and appearance[5]. Major metabolic processes take place at this level, involving the production, transportation and storage of apoproteins and lipoproteins, as well as catabolism of various lipids and excretion of cholesterol and phospholipids. An alteration in liver functions resulting from cellular injury leads to changes in the serum concentration of cholesterol and lipoproteins[6-8].

C-reactive protein (CRP) is predominantly produced in liver in response to inflammation. It opsonizes and activates the complement system due to the production of IL-6. Thus, it serves a significant role as a marker of inflammation in the inflammatory process[9]. As a result, high C-reactive protein levels have been observed in patients with liver failure and were recently associated with poor prognosis among patients with cirrhosis.[10] Though previous studies in developed countries were found that conducted among patients with liver cirrhosis, however there is a lack of data on both CRP and serum lipid profile of this patients in developing countries, especially in Bangladesh. As there is an upward trend of rising liver cirrhosis patients in Bangladesh, the present study aimed to expatiate the CRP and lipid profile of cirrhotic patients in Chattogram district of Bangladesh. This study determined the lipid profile, such as TC, HDL, LDL, VLDL, TG, and CRP level of cirrhotic patients compared with that of healthy individuals. This study aimed to determine the C-reactive protein (CRP) and lipid profile in cirrhotic patients as well as their correlation with patients' age and body mass index.

Methodology

Study Settings & Population: This case-control study was conducted in the Chittagong Medical College Hospital and People's Hospital Limited, Chattogram from October 2017 to March 2018 for a period of six months. This study recruited both liver cirrhosis patients and healthy individuals from the Chittagong Medical College Hospital and People's Hospital Limited, Chattogram. Blood samples were collected from 50 participants divided into 25 patients as cases and 25 healthy volunteers as controls. A standard questionnaire was developed to document the patient's disease history. Patients were identified with the help of diagnosis report. We also obtained the ethical permission to approve the protocol. An informed consent form was distributed to each volunteer before participating in the study. They were free to withdraw from the study at any time. Patients with liver complications except cirrhosis, skin problems and kidney failure were excluded from the study. Controls were matched by sex, age and socio-economic conditions.

Study Procedure: Venous blood was collected from each patients and controls after 8 h overnight fasting. After allowing the blood samples to stand at room temperature for half an hour, they were centrifuged at 3000 rpm for 15 min to extract the serum. Then, an Eppendorf tube was used to aliquot the extracted serum. Finally, the obtained serum was stored at -80^0C until going for CRP and lipid profile determination. C reactive protein (CRP) and lipid profile were then evaluated by using these samples. Colorimetric enzyme method was used to determine the serum lipids, total cholesterol, HDL cholesterol, LDL cholesterol, VLDL cholesterol and TG values. A dust free environment was maintained to avoid the possible interference in the test readings. CRP of serum sample was determined by gently shaking the latex reagent to disperse the particles. The disposable pipette was used to place a drop of undiluted serum onto the circle of the test slide. After that, one drop of the latex reagent was added next to the drop of serum. Then, the reagent and serum sample were extended over the entire

area of the test circle by using the other end of the pipette (broad end). The slide was rotated at 100 rpm for two minutes to obtain the agglutination. A level of CRP in the sample equal or > 6mg/l was calculated by observing the existence of agglutination. On the other hand, a CRP level < 6mg/l in the sample was documented by observing the lack of agglutination. Semi-quantitative test can be done in the similar way by using serial dilutions of the serum in saline, phosphate buffered saline or glycine saline if agglutination is present.

Statistical Analysis: In this study, Microsoft Excel 2010 and Statistical Package for the Social Sciences (SPSS 20) software were used for data processing and statistical analysis. Mean and standard deviation were calculated for descriptive analysis of quantitative variables. Mean and standard deviation were used. Chi-square test at 5% confidence interval was used for statistical analysis.

Results

Socio-demographic profile and clinical characteristics: Mean ± SD (standard deviation) expresses the age and BMI of the study participants. Age of the patients and healthy individuals was 49.52 ± 6.844 and 48.16 ± 7.856 years. About 21.94 ± 0.988 and 22.37 ± 1.081 were documented for the BMI of patients and control groups. Our study found that prevalence of liver cirrhosis was more frequent among male (64%) compared with that of female (36%). In addition, educated (above SSC 48%) and urbane (68%) people were mostly affected by liver cirrhosis. Moreover, employee (48%) of different organization was more frequently suffered the liver cirrhosis than labor (16%), housewife (28%) or businessman (8%). The health condition of most of the patients was poor (44%) or fair (40%) (Table 1).

Table1: Socio-demographic and clinical characteristics of the study population

Variables	Patients with Liver Cirrhosis (n=25)	Control Group (n=25)
Age(years)	49.52±6.844	48.16±7.856
BMI (kg/m2)	21.94±0.988	22.37±1.081
Gender		
Men	16 (64%)	8 (32%)
Women	9 (34%)	17 (68%)
Education		
Primary	3 (12%)	16 (64%)
SSC	10 (40%)	3 (12%)
Above SSC	12 (48%)	6 (24%)
Residential area		
Rural	8 (32%)	22 (88%)
Urban	17 (68%)	3 (12%)
Occupation		
Labor	4 (16.0%)	2 (8.0%)
Housewife	7 (28.0%)	17 (68.0%)
Employee	12 (48.0%)	6 (24.0%)
Businessman	2 (8.0%)	0(0.0%)
General health condition		
Poor	11 (44.0%)	0(0.0%)
Fair	10 (40.0%)	3(12.0%)
Good	4 (16.0%)	18(72.0%)
Excellent	0(0.0%)	4(16.0%)

Values were expressed in mean ± SD; BMI = Body Mass Index

C-reactive protein and serum lipid profile: CRP value and lipid profile such as TG, TC, HDL and LDL value of patients were compared with that of healthy individuals. Significantly (p = 0.00) higher C-reactive protein was observed among the patients of liver cirrhosis than the control group with the value of 2.448±1.174 and 0.648±0.166 mg/dL respectively. On the other hand, it was observed that the mean lipid profile of cirrhotic patients was huge lower than the healthy individuals. This present study also determined the statistically significant (p = 000 for each) lower value of the TG, TC and LDL of the patient group than the control. However, the HDL value was not significantly lower (p = 08). In addition, the serum TG; TC; HDL and LDL levels of cirrhotic patients were 100.228±20.564 mg/dl; 132.228±15.352 mg/dl 53.081±9.994 mg/dl and 59.110±18.634 mg/dL respectively compare to 139.842±17.395 mg/dL; 182.087±15.060 mg/dL, 73.358±20.694 mg/dL and 86.550±18.508 mg/dL respectively of the control group (Table 2).

Table 2: Comparative CRP Value and Lipid Profile between Patients and Control Groups

Items	Group	Mean±SD	P value
CRP (mg/dL)	Control	0.65±0.166	0.000*
	Patient	2.45±1.174	
TG (mg/dL)	Control	139.84±17.395	0.000*
	Patient	100.23±20.564	
TC (mg/dL)	Control	182.09±15.060	0.000*
	Patient	132.23±15.352	
HDL	Control	73.36±20.694	0.800

(mg/dL)	Patient	53.08±9.994	
LDL (mg/dL)	Control	86.55±18.508	0.000*
	Patient	59.11±18.634	

[a]Values are expressed in mean ± SD; significant at *P<0.05 compare to control; CRP = C-Reactive Protein; TG = Triglyceride; TC = Total Cholesterol; HDL = High Density Lipoprotein; LDL = Low Density Lipoprotein

Correlation analysis of the variables: Relationship between variables is established by using Pearson's correlation test. Association of various lipid parameters with age and BMI was elucidated in table 3. Positive correlation indicates the upward tendency of CRP and lipid profile with increasing age and BMI values. But, negative correlation indicates the opposite scenario. Our study found a positive correlation of BMI (r = 0.373), CRP (r = 0.03), TC (r = 0.16), HDL (r = 0.257) and LDL (r = 0.076) with the age of the patients.

In addition, same positive results were also observed between BMI and TG (r = 0.244); TC (r = 0.436); HDL (r = 0.281) and LDL (r = 0.329). The relationship between TG and TC of the cirrhotic patients was also positive (r = 0.230). But an inverse association was found between Age and TG (r = -0.025); BMI and CRP (r = -0.377); CRP and TC (r = -0.252) of the patients with liver cirrhosis. Our study also illustrated the correlation between different variables in case of healthy individuals where a different scenario of results compared with the patients was observed. This study demonstrated a positive association of CRP and HDL value with the age of healthy individuals. However, an inverse correlation of TG, TC and LDL with age was found in this study. Moreover, TG and HDL were positively associated with BMI. In addition, CRP; TC, LDL levels were inversely associated with BMI level. Inverse relationship was also found between TG and TC; CRP and TC.

Table 3 Correlation of every variable with each other's

Correlation Parameters	Patients (r value)	Control (r value)
Age and BMI	0.373	-0.118
Age and CRP	0.03	0.147
Age and TG	-0.025	-0.164
Age and TC	0.16	-0.534
Age and HDL	0.257	0.243
Age and LDL	0.076	-0.498
BMI and CRP	-0.377	-0.282
BMI and TG	0.244	0.421
BMI and TC	0.436	-0.119
BMI and HDL	0.281	0.319
BMI and LDL	0.329	-0.094
TG and TC	0.23	-0.157
CRP and TC	-0.252	-0.14282

[a]Values with negative sign indicate an inverse correlation; CRP = C-Reactive Protein; TG = Triglyceride; TC = Total Cholesterol; HDL = High Density Lipoprotein; LDL = Low Density Lipoprotein; BMI = Body Mass Index

Discussion

Our study was undertaken to evaluate the C-reactive protein (CRP) and lipid status of patients with liver cirrhosis in Chattogram district in Bangladesh. CRP is widely measured as a biomarker of inflammation in both infectious and non-infectious disease entities[11]. Indeed, the role of CRP in diagnosing bacterial infections in patients with impaired liver function is in conflict with studies debating whether it really represents a reliable marker[12]. Other studies have correlated CRP as a factor independently associated with mortality in patients with liver cirrhosis[10]. The variations in C-reactive protein (CRP) levels have been reported to have prognostic significance in decompensated cirrhotic patients. In a study of 148 patients with cirrhosis was associated with high baseline of CRP level[13]. Our findings also confirmed the output of these studies.

Analysing the lipid profile alterations, it was observed significant association between cholesterol reduction and Liver cirrhosis. But, the higher C-reactive protein level was associated with liver cirrhosis. The findings of this study indicated that serum levels TG, total cholesterol (TC), HDL and LDL cholesterol (but not VLDL cholesterol) were lower in patients with liver cirrhosis, irrespective of their viral etiology. But no significant changes were observed in HDL levels between cirrhotic patients and control group.

As previous study demonstrated that cholesterol and triglyceride (TG) levels were influenced by the severity of chronic viral hepatitis[14]. The present study has taken the paradigm further, proving that the reduced level of cholesterol, TG, HDL and LDL was associated with liver cirrhosis. This study also confirmed the previous studies that revealed an alteration of lipid metabolism in advanced stages of viral liver cirrhosis[15-18].

According to this study it was found abnormalities in serum lipid profiles. The serum lipid profile (total cholesterol, TG, HDL, and LDL) is

significantly decreased in cirrhotic patients. Suggested that HDL may be clinically useful to indicate pathologic conditions, and can be used to evaluate the severity of liver diseases. Low HDL has long been known to be a strong and independent risk factor for coronary artery disease even when the LDL level is low[19].

A significantly positive relationship was observed between Age and BMI, Age and CRP, Age and TC, Age and HDL, Age and LDL, BMI and TG, BMI and TC, BMI and HDL, BMI and LDL, TG and TC. We faced some limitations to carry out this study. It was very difficult to get the available cirrhotic patients. In addition, it was not possible to perform the histological diagnosis due to several barriers. History, biochemical evidence and clinical findings on which we relied might not be accurate in every case. However, this study may play an important role as a baseline for further studies with liver cirrhosis patients regarding CRP and Lipid abnormalities as well as epidemiological study of cirrhotic patients.

Conclusion

CRP is a biomarker of inflammation associated with liver-cirrhosis. It is produced in liver as an acute phase reactant. The concentration of CRP is increased in inflammatory condition. As a result, the intensity of inflammation associated with liver cirrhosis is indicated by the concentration of CRP. Lipid abnormalities is also a common phenomenon in patients with liver cirrhosis. Serum lipid status (total cholesterol, TG, HDL, and LDL) is significantly decreased in cirrhotic patients. The extent of reduction (except HDL) is related to the progress in cirrhosis. Further studies are required to determine the predictive values of determining lipid profiles as a means to estimate the extent of liver damage in cirrhotic patients. Analysis of serum levels of lipids in patients with liver-cirrhosis may reflect the extent of hepatic cellular impairment, and may also be used as an indicator to evaluate a patient's prognosis.

References

1. Moriwaki H, Miwa Y, Tajika M, Kato M, Fukushima H, Shiraki M. Branched-chain amino acids as a protein-and energy-source in liver cirrhosis. Biochemical and biophysical research communications. 2004;313(2):405-9

2. Schuppan D, Afdhal NH. Liver cirrhosis. The Lancet. 2008;371(9615):838-51

3. Braet F, Wisse E. Structural and functional aspects of liver sinusoidal endothelial cell fenestrae: a review. Comparative hepatology. 2002;1(1):1-7

4. Aravind K, S KalghatgI, N Shubhlaxmi, K Mukund and K Vinayak. Analysis of upper gastro-intes nal endoscopic ndings in pa ents with gallstone disease who present with dyspepsia. Int J Contemp Med Surg and Radiol 2018; 3(1):8-11

5. Mehboob F, Ranjha FA, Masud S. Changes in Serum Lipid Profile Among Patients Suffering From Chronic Liver Disease. Annals of King Edward Medical University. 2007;13(3):209

6. Cimminiello C, Soncini M, Gerosa MC, Toschi V, Motta A, Bonfardeci G. Lipoprotein (a) and fibrinolytic system in liver cirrhosis. Biomedicine & pharmacotherapy. 1995;49(7-8):364-8

7. Jármay K, Karácsony G, Nagy A, Schaff Z. Changes in lipid metabolism in chronic hepatitis C. World journal of gastroenterology: WJG. 2005;11(41):6422

8. Kaye GL, Kruszynska YT, Harry DS, Heslop K, Johnston DG, McIntyre N. Lipid metabolism and insulin resistance in cirrhosis. Journal of hepatology. 1994;20(6):782-91

9. Marnell L, Mold C, Du Clos TW. C-reactive protein: ligands, receptors and role in inflammation. Clinical immunology. 2005;117(2):104-11

10. Cervoni JP, Thévenot T, Weil D, Muel E, Barbot O, Sheppard F, Monnet E, Di Martino V. C-reactive protein predicts short-term mortality in patients with cirrhosis. Journal of hepatology. 2012;56(6):1299-304

11. Castelli GP, Pognani C, Meisner M, Stuani A, Bellomi D, Sgarbi L. Procalcitonin and C-reactive protein during systemic inflammatory response syndrome, sepsis and organ dysfunction. Critical care. 2004;8(4):1-9

12. Bota DP, Van Nuffelen M, Zakariah AN, Vincent JL. Serum levels of C-reactive protein and procalcitonin in critically ill patients with cirrhosis of the liver. Journal of Laboratory and Clinical Medicine. 2005;146(6):347-51

13. Mendall MA, Strachan DP, Butland BK, Ballam L, Morris J, Sweetnam PM, Elwood PC. C-reactive protein: relation to total mortality, cardiovascular mortality and cardiovascular risk factors in men. European heart journal. 2000;21(19):1584-90

14. Habib A, Mihas AA, Abou-Assi SG, Williams LM, Gavis E, Pandak WM, Heuman DM. High-density lipoprotein cholesterol as an indicator of liver function and prognosis in noncholestatic cirrhotics. Clinical gastroenterology and hepatology. 2005;3(3):286-91

15. Fierro NA, Gonzalez-Aldaco K, Torres-Valadez R, Martinez-Lopez E, Roman S, Panduro A. Immunologic, metabolic and genetic factors in hepatitis C virus infection. World Journal of Gastroenterology: WJG. 2014;20(13):3443

16. Ghadir MR, Riahin AA, Havaspour A, Nooranipour M, Habibinejad AA. The relationship between lipid profile and severity of liver damage in cirrhotic patients. Hepatitis monthly. 2010;10(4):285

17. Honda A, Matsuzaki Y. Cholesterol and chronic hepatitis C virus infection. Hepatology Research. 2011;41(8):697-710

18. Popescu CI, Dubuisson J. Role of lipid metabolism in hepatitis C virus assembly and entry. Biology of the Cell. 2010;102(1):63-74

19. Castelli WP. Cholesterol and lipids in the risk of coronary artery disease--the Framingham Heart Study. The Canadian journal of cardiology. 1988;4:5A-10A