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Original research article

Evaluation of liver dysfunction and dyslipidemia in patients with non-alcoholic fatty liver disease

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Abstract

Background and aim: The aim of this study was to determine the lipid profile and liver function tests in patients with nonalcoholic fatty liver disease (NAFLD) and to examine their relationship with NAFLD at various degrees.

Material and methods: We included 60 patients of non-alcoholic fatty liver disease in this study, this was a cross section type of study in which lipid profile and liver function tests were performed.

Results: Total cholesterol (TC), triglyceride (TG), low-density lipoprotein (LDL) and very low-density lipoprotein (VLDL) were increased by 45%, 36%, 60% and 43%, respectively, in NAFLD patients.High-density lipoprotein (HDL) levels are low in 33% of NAFLD patients. Similarly, serum aspartate aminotransferase (AST) and alanine aminotransferase (ALT) were elevated (48% and 37%) respectively, while Serum albumin (31%) decreased in NAFLD patients. Progression in NAFLD was associated with increases in serum TC, TG, VLDL, AST and ALT. At the same time, HDL and albumin decreased.

Conclusions: Dyslipidemia patterns of lipid markers and abnormal liver function tests have been observed in NAFLD patients. Dyslipidemia and elevated AST and ALT levels are also associated with increased fatty liver levels in NAFLD patients.

Keywords: Non-alcoholic fatty liver, fatty liver, liver enzymes, lipid profile

1. Introduction

Nonalcoholic fatty liver disease (NAFLD) is a growing liver disease component of the metabolic syndrome. NAFLD is defined as≥5%hepatic steatosis (HS) in the absence of competing etiologies of liver disease, such as chronic liver disease, use of steatosis-inducing drugs (e.g.,amiodarone or tamoxifen) and otherliver diseases, Examples include, hemochromatosis, Wilson's disease, autoimmune hepatitis or excessive alcohol consumption. Its prevalence varies from region to region. For example, the prevalence of NAFLD is 27.37% in Asia and 24.13% in North America, with the highest prevalence in the Middle East(31.79%) andthe lowest in Africa (13.79%).48%) [1, 2, 23]. The incidence of NAFLD is predicted to increase overall [3, 4]. An important difference in NAFLD patients is dyslipidemia characterized by hypertriglyceridemia, low-hi density lipoprotein cholesterol (HDL-C) and elevated very low-density lipoprotein (VLDL) and low-density lipoprotein cholesterol (LDL-C)[5, 6]. The best way to detect deposition of fatin the liver among thepopulation is liver ultrasonography [7, 11]. Patients often seek treatment from a gastroenterologist or hepatologist because of abnormal transaminase levels. Therefore, many studies have used abnormal aspartate aminotransferase (AST) and alanine aminotransferase (ALT) levelsto diagnose NAFLD[8, 9].Therefore, in clinical practice, measurements of transaminases, blood lipids, and insulin resistance (IR) are often used to diagnose NAFLD. Blood lipid profile, AST, ALT, fasting blood glucose (FG), CRP and fasting insulin levels play an important role in NAFLD. These indicators help to understand the severity and outcome of the disease and also facilitate early intervention and are a good alternative to liver biopsy[10, 11, 22]. The aim of this study was to determine the lipid profile and liver function tests in patients with NAFLD and to examine theirassociation with various degrees of NAFLD.

2. Material and methods

This cross-sectional study was conducted from November 2022 to august 2023at the Department of Biochemistry of R.D. Gardi Medical College, Ujjain, India. This study was conducted under the approval of the Institutional Ethics committee (IEC Ref.No.-21/2022).Sixty male and female patients with nonalcoholic fatty liver disease (NAFLD) aged 18 to 60 years were recruited from Medical Ward, R.D.

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Gardi Medical College Ujjain and its affiliated C.R. Gardi hospital, Madhya Pradesh, India. After fully explaining the study to all participants, they gave written informed consent. Coding and computer recording were used to protect the privacy of study materials.

Patients with history of alcohol use,smokers,cancer patients,past gastric bypass surgery,history of drug use and patients on steroids, synthetic estrogens, heparin, calcium channel blockers and other liver diseases such as viral and autoimmune liver diseases are considered exclusion criteria for this study. After receiving consent form and explaining the research objectives, the personal information of the subjects(age, gender, and level of education, occupation, place of residence, marital status and smoking) was completed face to face. Blood pressure (mmHg) was measured by cuff pressure gauge considering standard medical procedure [13]. Venous blood sample was taken from all participants after 12 h of fasting, and then sent to the laboratory of the unit on the same day. Parameters including hepatic enzymes such as aspartate aminotransferase (AST), alanine aminotransferase (ALT) and Serum albumin as well as the lipid profile including triglyceride (TG), total cholesterol (TC), high density lipoprotein cholesterol (HDL,C) and fasting blood sugar (FBS) were examined by dry chemistry slide technique using vitros 5600 integrated analyzer. LDL and VLDL cholesterol were calculated using the Friedwald equation.

Abdominal ultrasonography was performed by ultrasonix device from sonix SP series using a deep probe of 3.5-5 MHz to detect fatty liver and confirmed by two radiologists residing in the C. R. Gardi hospital. According to ultrasonography results, hepatic steatosis is divided into three grades:

Grade 1 (mild): Hyperechoic liver parenchyma, portal vein and diaphragmatic vein can be seen.

Grade 2 (moderate): Hyperechoic liver parenchyma, portal vein branch wall obstruction, no diaphragm obstruction.

Grade 3 (severe): Echo-enhanced liver parenchyma, undetectable periportal echo and diaphragmatic occlusion.

This grading is based on standards recognized by the American Gastroenterological Association [12]. Subjects in this study were classified as NAFLD group with any degree and severity of liver disease.

Statistical analysis

All analyzes were performed using the Microsoft excel software. Categorical variables were presented as number (%),numerical variablesas mean and standard deviation (SD). P value was calculated by one-way analysis of variance (ANOVA), and a p value less than 0.05 was considered significant.

3. Results

Of the 60 NAFLD cases detected by ultrasound, 30 patients (50%) were grade I NAFLD, 20 patients (33%) were grade II, and 10 patients (16%) were grade III. Table 1 shows the main characteristics of the subjects. The mean age of NAFLD patients was 51.4 years. Likewise, the subjects had a mean BMI of 28.03 kg/m². The systolic and diastolic blood pressures of the NAFLD patients were 124.28 mmHg and 80.56 mmHg, respectively. The average blood sugar level in the blood was (111.98 mg/dl).

Table 2 shows abnormal % of biochemical parameters among NAFLD cases. Serum TC, TG, LDL and VLDL levels were elevated in 45%, 36%, 60% and 43% of NAFLD patients, respectively. Serum HDL levels were decreased in 33% of NAFLD patients. Table 3 compares lipid changes at different grades of NAFLD using analysis with analysis of variance (ANOVA). It was reported that the increase in NAFLD level was associated with the increase in serum TC, TG and LDL, while there was also a decrease in HDL. There was nosignificant relationship betweenserum VLDL levels and increased NAFLD levels. Table 4 compares liver enzymes and albumin at differentNAFLD levels with analysis by analysis of variance (ANOVA). The study found that the increase in NAFLD levels was associated with an increase in serum AST and ALT levels. It is also reported that albumin levels decrease. The study found no significant association between the AST/ALT ratio and progressive NAFLD.

Table 1: Baseline characteristics of studied subjects

Variables	NAFLD (n=50)
Sex (M/F)	35/25
Age (years)	51.4±13.27
BMI (Kg/m2)	28.03±6.77
SBP (mmHg)	124.28±17.34
DBP (mmHg)	80.56±10.00
FBG (mg/dl)	111.98±17.35

BMI=Body mass index; SBP=Systolic blood pressure; DBP=Diastolic blood pressure; FBG= Fasting blood glucose.

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Table 2: Abnormal % of biochemical parameters among NAFLD cases

Lipid parameter	Cut off range	Abnormal % of total NAFLD cases
Total cholesteol	>200 mg/dl	45%
Triglyceride	>200 mg/dl	36%
HDL-Cholesterol	<40 mg/dl	33%
LDL-Cholesterol	>120 mg/dl	60%
VLDL-Cholesterol	>35mg /dl	43%
AST	>40 IU/L	48%
ALT	>40 IU/L	37%
Albumin	<3.5 gm/dl	31%

Table 3: Comparison of lipid changes in different grades of NAFLD

Grades of NAFLD.	Grade I		Grade II		Grade III		P-value
Lipid Profile(mg/dl)	Mean	SD	Mean	SD	Mean	SD	
Total Cholesteol	**188.8**	55.42	**212.45**	18.38	**262.5**	89.37	0.0142*
Triglyceride	**164.2**	95.09	**204**	78.78	**244.1**	65.66	0.0333*
HDL-Cholesterol	**38.36**	10.86	**32.4**	11.69	**28.4**	11.96	0.0357*
LDL-Cholesterol	117.93	31.36	124.6	23.83	139.9	49.71	0.1947NS
VLDL-Cholesterol	**32.84**	19.01	**40.8**	15.75	**48.82**	13.13	0.0333*

Table 4: Comparison of liver function tests between different grades of NAFLD

Ultrasound Grades	Grade I		Grade II		Grade III		P-value
Liver Function Tests	Mean	SD	Mean	SD	Mean	SD	
AST (U/L)	**38.13**	**9.02**	**44.8**	10.85	54.2	11.11	0.00017*
ALT (U/L)	43.4	16.00	55.5	16.56	60.4	13.36	0.0044*
Albumin (gm/dl)	3.26	0.68	3.04	0.38	2.61	0.43	0.0085*
AST/ALT	0.951	0.31	0.852	0.23	0.916	0.19	0.45NS

NS: Not significant; *Significant; AST: Aspartate transaminase; ALT: Alanine transaminase.

4. Discussion

Patients with varying degrees of NAFLD were included in this clinical observational study. In this study, an attempt was made to identify abnormalities in serum lipid and liver function tests in NAFLD patients. Our study showed that serum triglyceride increased in 36%, total cholesterol in 45%, LDL in 60%and VLDL in 43% of NAFLD patients. 33 percent of NAFLD patients have low levels of HDLin their blood. In this study, NAFLD was mostly male and comprised almost 58.33% of patients. Similar results have been observed by Shivram Prasad *et al*. in cases with male predominancein NAFLD cases[13].Jen Jung Pen and others, Gender distribution of NAFLD patients was also examined and male dominance was observed. According to Jen Jung Pen *et al*., this is due to differences in body fat, lifestyle and sex hormone metabolism[14].However, in a study by Dhumal*et al*.,the gender distribution of NAFLD patientswas mostly female[15].

According to DS Baghe l*et al*., Serum TC, TG, LDL and VLDL levels were elevated in 54%, 68%, 42%, and 38% of NAFLD patients, respectively. Serum HDL levels were decreased in 36% of NAFLD patients. In contrast our study could not find any significance correlation in vldl with severity of NAFLD but LDL cholesterol shows strong correlation with advancing stages of fatty liver[2].Similarly, Khalil *et al*. Total cholesterol, triglycerides, LDL and VLDL were elevated in 58%, 61%, 49% and 39% of NAFLD patients, respectively. But their research found that 49 percent of NAFLD patients had low HDL. They also found significant associations between advanced NAFLD and an increase in total cholesterol, triacylglycerols, LDL and VLDL, and a decrease in HDL[17].Kanal*et al*. Serum triglycerides, total cholesterol and LDL levels were elevated in 6%, 27.5% and 1.8%, respectively, of NAFLD patients. HDL levels were low in 20.2% of NAFLD patients[18].Thong VD *et al*., found significance of AST and ALT levels in advance stages of hepatic fibrosis, in our study also there were positive correlation of AST and ALT with advance grade of fatty liver[19].Amini-Salehi E and colleague also found similar correlation like our study[20].Takahashi H, *et al*., shows hypo albuminemia with hepatic fat accumulation,we also discover low albumin in all stages of fatty liver and significance decrease with severity of disease[21].Kang SH *et al*., found albuminuria in patients of fatty liver may be one of the factor for hypo albuminemia which is to be explore more[24].The prerequisite for the development of NAFLD is the accumulation of lipids (mainly triglycerides) in hepatocytes. The main metabolic abnormalities leading to fat accumulation are unknown. However, they may be involved in changes in liver lipid metabolism in the pathways of absorption, synthesis, degradation or secretion. These changes may be caused by insulin resistance, which is the most important factor in the development of NAFLD[22].One limitation of this study is the use of ultrasound to diagnose NAFLD. Liver biopsy is the gold standard for diagnosing fatty liver, butit is not recommended for the general public due to its many complications, high risk of complications, and high cost. Abdominal ultrasonography, on the other hand,is a

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noninvasive, low-risk, simple, low-cost and simple procedure. Simultaneous analysis of two radiologists was used in this study to control this limitation.

5. Conclusion

The results of this study show that biochemical markers are significantly altered in NAFLD patients. lipid changes and liver enzymes alters with significant fat deposition in liver,thus biochemical changes should be further investigated with sonography and other supportive tests to timely intervention and preventing further liver damage.

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