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Original Research Article

Correlation between NAFLD and Metabolic Syndrome

Dasaraju Suma[1], Rengaraj Rengaraj[2], Leelakrishna Santhosh[3]

[1]Professor, [2]Assistant Professor, [3]Postgraduate,
Department of General Medicine, the Oxford Medical College, Hospital and Research Centre, Bangalore, Karnataka, India.
and Research Centre, Bangalore, Karnataka, India.

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Corresponding author: Dr. Rengaraj Rengaraj
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Abstract

Background: Non-alcoholic fatty liver disease (NAFLD) is the most common liver disease with a prevalence rate of 20% to 30 % in western countries. Studies introduced that NAFLD may progress to liver failure, cirrhosis and HCC (hepatocellular carcinoma).[2]Available data from Clinical, experimental, and epidemiological studies indicates NAFLD may be the hepatic manifestation of metabolic syndrome.

Aim: To study the correlation between the non-alcoholic liver disease and metabolic syndrome.

Methods: 50 Non-Alcoholic Fatty Liver Disease patients diagnosed by USG abdomen were enrolled in this study from august 2019 to December 2019. Patients were categorized into 3 grades of fatty liver. Parameters of metabolic syndrome (according to ATP III criteria) were assessed and correlated with the grade of fatty liver.

Results: Out of 50 patients 27 (54%) females and 23 (46%) were males. Mean age of presentation was 45.12 years. 34(68%) patients had mild grade, 10 (20%) had moderate grade and 6(12%) patients had severe grade fatty liver. Among 50 patients 28 (56%) had low HDL levels (p =0.39), 30 (60%) patients had increased Triglyceride levels (p =0.03), 23 (46%) patients had increased waist circumference (p=0.05), 22(44%) patients had high blood pressure (p=0.01) and 37 (74%) patients had elevated Fasting blood glucose levels with a significant p value 0.02. As the number of components of metabolic syndrome was increased the grade of NAFLD had also increased with a significant p value (< 0.0001).

Conclusion: The presence of multiple components of metabolic syndrome like hypertension, obesity, dyslipidaemia and diabetes mellitus in a same person increases the grade of NAFLD and liver injury.

Keywords: NAFLD, Metabolic Syndrome, Obesity, DM, Hypertension.

Introduction

Non-alcoholic fatty liver disease (NAFLD) is one of the most common liver pathologies worldwide with a 20-30% estimated prevalence in the western countries. It represents a spectrum of liver disease ranging from fatty liver to hepatitis. [1] In the year 1980, Ludwig et al first coined the term NAFLD. [2]

NAFLD is characterized by increased fat deposition in the liver without any significant alcohol consumption or any obvious cause of steatohepatitis. Even if the person consumes alcohol, it should be less than the threshold limit of 30 g/day for men and 20 g/day for women. [3]

Even though NAFLD can progress to cirrhosis of liver and hepatocellular carcinoma, the cardiac and metabolic complications which occur due to this are the important reasons for patient morbidity and mortality. [4] The higher prevalence of NAFLD is associated with metabolic syndrome.

In many countries, more than 80% of NAFLD patients have an increased BMI and 30-40% are obese; approximately 50% show signs of insulin resistance, 20-30% have type 2 diabetes, 80% show hyperlipidaemia, and 30-60% have arterial hypertension. Using liver ultrasonography, a recent population-based cohort study performed in Italy found that one in four or five adults in that country suffer from NAFLD. [5]

In 2005 the American Heart Association (AHA) and the National Lung Heart and Blood Institute updated the ATP III criteria with minor modifications. Thus, the metabolic syndrome is defined by the presence of three or more of the following components [6]:

Abdominal obesity (waist circumference >102cm in men and >88cm in women).

Elevated triglycerides (>150 mg/dl or on drug treatment for elevated triglycerides).

Reduced HDL-C level (<40mg/dl in men and <50 mg/dl in women or on drug treatment for reduced HDL-C).

Hypertension (SBP >130mmhg or DBP >85mmhg or on antihypertensive drug treatment).

Impaired fasting glucose (100-125mg/dl or on antidiabetic drug treatment).

Available data from Clinical, experimental, and epidemiological studies indicates NAFLD may be the hepatic manifestation of metabolic syndrome.6 Liver biopsy remains the gold standard in the diagnosis and prognosis of NAFLD, but being invasive has limitation for patient consent. [2]

We conducted this study to know the correlation of Non-Alcoholic Fatty Liver Disease with the parameters of metabolic syndrome.

Aim: To study the correlation between the non-alcoholic fatty liver disease and metabolic syndrome

Objectives:

To study the clinical profile of patients with non- alcoholic fatty liver disease.

To study the correlation between the non-alcoholic fatty liver disease and metabolic syndrome

Materials & Methods

This study was undertaken for a period of six months from august 2019 to December 2019 on patients who attended OPD and IPD of Department of General Medicine, The Oxford Medical College Hospital & Research Centre, Yadavanhalli, Attibele, Bangalore. This was a cross sectional study conducted after obtaining clearance from our institutional ethics committee.

Inclusion criteria:

People above 18 years of age.

No history of Alcohol intake

Raised liver enzymes – AST, ALT at least 1.5 times above the upper limit of normal.

USG findings – diffuse fatty infiltration.

Exclusion criteria:

Positive test for HBsAg Antigens and anti-HCV antibodies.

Past h/o liver disease.

On medications that induce fatty liver disease like methotrexate, oestrogen,

amiodarone, tamoxifen, corticosteroids, tetracycline's.

Hepatocellular Carcinoma.

H/O gastrointestinal bypass surgery.

Patients not willing to give consent for the study.

50 random patients attending the OPD and IPD of General Medicine Department meeting the inclusion criteria were subjected to detailed history taking with special reference to alcohol consumption. All subjects were examined in detail with special reference to Blood Pressure, Body Mass Index (BMI) and waist circumference. All patients underwent ultrasonography of abdomen to diagnose and grade NAFLD. Using Ultrasound B mode, Steatosis can be graded as follows: Absent (score 0) when the echotexture of the liver is normal; mild (score 1), when there is a slight and diffuse increase of liver echogenicity with normal visualization of the diaphragm and of the portal vein wall; moderate (score 2), in case of a moderate increase of liver echogenicity with slightly impaired appearance of the portal vein wall and the diaphragm; severe (score 3), in case of marked increase of liver echogenicity with poor or no visualization of portal vein wall, diaphragm, and posterior part of the right liver lobe.[7] To evaluate the association of NAFLD with metabolic syndrome laboratory tests Fasting blood glucose, Liver function tests and serum lipid profile were done.

Statistical analysis:

The clinical and laboratory characteristics of the patients were expressed as medians [range], or number [proportion] of the patients. Results were expressed as mean ± standard deviation [SD]. Mean values were compared by unpaired Student's t test for parametric data. To compare the proportion, chi-square test was used. P value less that 0.05 was accepted as statistically significant.

Results:

Out of 50 patients 27 (54%) females and 23 (46%) were males. Mean age of presentation was 45.12 years. 34(68%) patients had mild grade, 10 (20%) had moderate grade and 6(12%) patients had severe grade fatty liver (Figure 1).

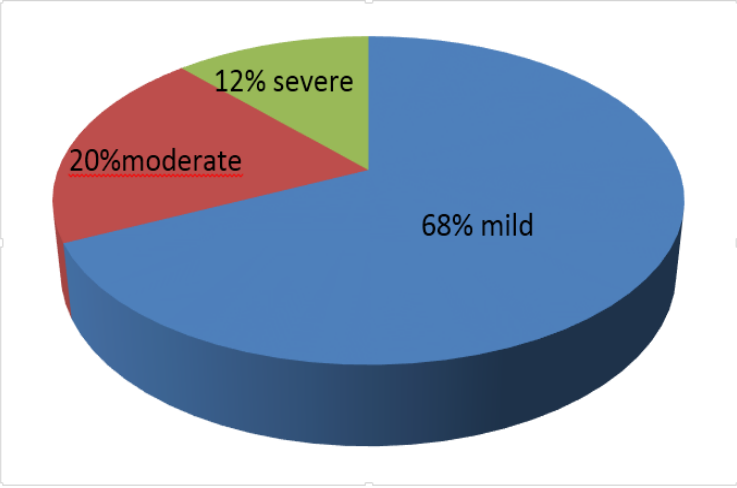

Figure 1: Different grades of NAFLD in study patients

In 50 patients studied about metabolic syndrome 32 (64%) patients had metabolic syndrome and 18 (36%) patients did not have metabolic syndrome according to ATP III criteria. But at least one component of metabolic syndrome was there in 3 (6%) patients, two components were there in 15 (30%) patients, three components were there in 24 (48%) patients, four components were there in 7 (14%) patients and all the five components were present in one patient. Among 50

patients 28 (56%) had low HDL levels (p =0.39), 30 (60%) patients had increased Triglyceride levels (p =0.03), 23 (46%) patients had increased waist circumference (p=0.05), 22(44%) patients had high blood pressure (p=0.01) and 37 (74%) patients had elevated Fasting blood glucose levels with a significant p value 0.02 (Table 1).

Table 1: Distribution of metabolic syndrome components in various grades of NAFLD

Metabolic syndrome components	Mild fatty liver (Score 1)	Moderate fatty liver (Score 2)	Severe fatty liver (Score 3)	P value
normal HDL	13(26%)	5(10%)	4(8%)	0.39
Reduced HDL	21(42%)	5(10%)	2(4%)	
normal TG	18(36%)	2(4%)	0(0%)	0.03
HIGH TG	16(32%)	8(16%)	6(12%)	
normal waist circumference	22(44%)	4(8%)	1(2%)	0.05
Increased waist circumference	12(24%)	6(12%)	5(10%)	
Normal FBS	13(26%)	0(0.0%)	0(0.0%)	0.02
High FBS	21(42%)	10(20%)	6(12%)	
normal BP	22(44%)	6(12%)	0(0.%)	0.01
High BP	12(24%)	4(8%)	6(12%)	

In our study we observed that as the triglyceride, fasting blood glucose levels, waist circumference and Blood Pressure are increasing the severity of fatty liver is also increasing with a statistically significant p value (Table 2).

Table 2: Increasing severity of components of metabolic syndrome in different grades of NAFLD

Metabolic syndrome components		Mild fatty liver	Moderate fatty liver	Severe fatty liver	P value
HDL mg/dl	>50 in Women + >40 in Men	13(26%)	5(10%)	4(8%)	0.7
	40 to 50 in Women 35 to 40 in Men	18(36%)	4(8%)	2(4%)	
	<40 in Women < 35 in Men	3(6%)	1(2%)	0(0%)	
Triglycerides in mg/dl	<150	18(36%)	2(4%)	1(2%)	0.003
	150-250	15(30%)	7(14%)	2(4%)	
	>250	1(2%)	1(2%)	3(6%)	
Waist circumference in inches	<88 in Women <102 in Men	22(44%)	4(8%)	1(2%)	0.01
	88 to 100 in Women 102 to 110 in Men	11(22%)	4(8%)	2(4%)	
	>100 in Women >110 in Men	1(2%)	2(45)	3(6%)	
Fasting Blood	<100	13(26%)	0(0%)	0(0%)	0.02

Glucose in mg/dl	100 to 150	15(30%)	6(12%)	2(4%)	
	>150	6(12%)	4(8%)	4(8%)	
BP in mmHg	<130/80	22(44%	6(12%)	0(0%)	0.02
	130/80 to 140/80	7(14%)	3(6%)	2(4%)	
	>140/80	5(10%)	1(2%)	4(4%)	

Out of 50 patients, 3(6%) patients had only one component of metabolic syndrome, 15 (30%) patients had two components, 24 (48%) patients had three components, 7 (14%) patients had four and 1 (2%) patient had five components of metabolic syndrome. As the number of components of metabolic syndrome was increased the grade of NAFLD had also increased with a significant p value (< 0.0001) (Table 3).

Table 3: Number of metabolic syndrome in different grades of NAFLD

Metabolic syndrome components	Grade 1 fatty liver	Grade 2 fatty liver	Grade 3 fatty liver	P value
1 COMPONENT	3(6%)	0(0%)	0(0%)	<0.0001
2 COMPONENTS	14(28%)	1(2%)	0(0%)	
3 COMPONENTS	17(34%)	6(12%)	1(2%)	
4 COMPONENTS	0(0%)	3(6%)	4(8%)	
5 COMPONENTS	0(0%)	0(0%)	1(2%)	

Discussion:

The present study was conducted to study the correlation of Non-Alcoholic Fatty Liver Disease with the parameters of metabolic syndrome. Patients with various degrees of fatty liver on ultrasound were categorized and compared with individual component of metabolic syndrome as a risk factor, increasing severity of individual component of metabolic syndrome as a risk factor and number of components as a risk factor for severity of NAFLD.

In our study the prevalence of metabolic syndrome in NAFLD patients is 64%. In a study conducted by Kotronen A et al, the prevalence of MS among NAFLD patients was 43% & concluded that, liver fat content is significantly increased in subjects with the MS as compared with those without the syndrome, independently of age, gender, and body mass index. [8]

In another study conducted by Kanwar P and et al, the prevalence of MS among NAFLD was 67%, prevalence of obesity among NAFLD was more (71%) compared to other components of MS and concluded that obesity has major risk in patients with MS to have NAFLD. [9]

In our study majority of the patients (48%) with NAFLD had 3 components of MS and one patient (2%) had all the five components of metabolic syndrome. In a study conducted by Kotronen A et al, Ninety percent of individuals with NAFLD have at least one component of MS, and 33% have all the components of MS. [8]

In our study the prevalence of obesity is 46%, prevalence of dyslipidaemia is 60%, prevalence of hypertension is 44% and prevalence of DM is 74% among NAFLD patients. Hence diabetes contributing more to the risk for NAFLD among MS patients.

In a study conducted by Younossi ZM et al, the prevalence of obesity was 51%, the prevalence of DM was 22.51%, dyslipidaemia is 69%, HTN was 39% and Metabolic syndrome is 42.5% among NAFLD patients. [10] Suggest that obesity and dyslipidaemia are contributing more to NAFLD in western countries. In another longitudinal study conducted by Kim D et al, obesity and visceral adipose tissue has associated with higher risk of incidence of NAFLD. [11]

In our study, as the severity of diabetes there is significant increasing in the severity of NAFLD. In a metanalysis conducted by Younossi ZM et al, concluded that high incidence of NAFLD in patients with type 2 DM. [12]

In our study as the components of metabolic syndrome is increased the severity of NAFLD also increased with very significant p value (0.0001). same results were seen in a study conducted by Pardhe BD et al, that there is an increased prevalence of all the components of metabolic syndrome in cases of NAFLD and whenever metabolic components are encountered in the clinical setting, patients must be evaluated for the diagnosis of NAFLD by imaging. [13]

In another study conducted by Wang Y et al, greater number of MS components was significantly associated with a higher risk of NAFLD ($p < 0.001$). Even in those with only one component of MS, the risk increased by 2.6-fold compared with that for the individuals without any components. [14]

Metabolic syndrome is associated with higher risk of NASH among NAFLD patients. In a longitudinal study conducted by Golabi P et al, the prevalence of each component of metabolic syndrome has increased the severity of NALFD and increased mortality by 8%, increased number of MS components was associated with increased severity of NAFLD and lower survival ($P < .0001$). [15]

In a study conducted by Marchesini G et al, presence of metabolic syndrome (MS) carried a high risk of NASH among NAFLD subjects ($p = 0.26$) & presence of multiple components of it is associated with a potentially progressive, severe liver disease. [16,17]

Conclusion: The presence of multiple components of metabolic syndrome like hypertension, obesity, dyslipidaemia and diabetes mellitus in a same person increases the grade of Non-Alcoholic Fatty Liver Disease and liver injury.

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