Prevalence of fatty liver in metabolic syndrome

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ABSTRACT

Background: In Western world, non-alcohlic fatty liver disease (NAFLD) is considered to be the commonest liver problem, and it is being recognised as a major cause of liver-related morbidity and mortality. As the prevalence of overweight/obesity and metabolic syndrome increases, NASH may become one of the more common causes of end stage liver disease and hepatocellular carcinoma. But much information is not available in this association. So an attempt has been made to correlate both. **Aims:** The aims of this study are: 1. to study the prevalence of non-alcoholic fatty liver in metabolic syndrome; and 2. to study the correlation between the non-alcoholic fatty liver and metabolic syndrome along with its individual components. **Materials and Methods:** The study was an observational and analytical study of patients attending OPD and indoor patients of the Department of Medicine, G.G.S. Medical College and Hospital Faridkot. In total, 100 patients diagnosed as metabolic syndrome according to the NCEP ATP III criteria were subjected to ultrasonography; age and sex matched 100 controls were also taken; and the relationship between metabolic syndrome and NAFLD was studied. **Results:** In total, 73% cases of metabolic syndrome according to NCEP ATPIII were having fatty liver, while in controls 38% persons were having fatty liver which is statistically significant. **Conclusions:** Fatty liver was found to be highly prevalent in metabolic syndrome, and the early detection of fatty liver can help in modifying the disease course and delaying more serious complications like cirrhosis of liver and hepatocellular carcinoma.

Keywords: Central obesity, dyslipidemia, metabolic syndrome, non-alcoholic fatty liver disease (NAFLD)

Introduction

The metabolic syndrome (syndrome X, insulin resistance syndrome) consists of a constellation of metabolic abnormalities that confer increased risk of cardiovascular disease (CVD) and diabetes mellitus (DM). The major features of the metabolic syndrome include central obesity, hypertriglyceridemia, low high-density lipoprotein (HDL) cholesterol, hyperglycemia, and hypertension. Fatty liver is relatively common. However, in NASH, both triglyceride accumulation and inflammation coexist. As the prevalence of overweight/obesity and the metabolic syndrome increases,

NASH may become one of the more common causes of end-stage liver disease and hepatocellular carcinoma. Non-alcoholic fatty liver disease (NAFLD) is now considered to be the commonest liver problem in the western world affecting 15–40% of the general population.[1] NAFLD ranges from simple steatosis to steatohepatitis, advanced fibrosis, and cirrhosis. It resembles that of alcohol-induced liver disease, but it also occurs in patients who do not abuse alcohol. Non-alcoholic steatohepatitis that is characterised by hepatic steatosis, liver cell injury, hepatic inflammation, fibrosis, and necrosis is believed to be an intermediate stage of NAFLD.

Burden of NAFLD in European countries ranges between 26% in Italy[2] and 30.4% in Pomerania,[3] in Asian countries it ranges between 11.8% and 24.4% in China,[4] and in Japan prevalence is up to 30%.[5] About its prevalence in the US, 39% of the patients of CLD are having NAFLD (Position Statement EASL 2009).[6]

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In India, NAFLD is quite common. Various studies show the prevalence of NAFLD ranging from 20% to 40%. A study by S.P. Singh *et al.* showed the prevalence of NAFLD as 24.5%.[7] In Southren India, a study by Mohan *et al.* showed overall prevalence as 32% in men and 29.1% in women, and it is still higher in diabetics (54.5%).[8]

This study is designed to diagnose patients with metabolic syndrome according to NCEP ATPIII criteria, and then subjecting these individuals to ultrasonography and patients are labelled to be having NAFLD according to standard criteria accepted by the American gastroenterololgy association, i.e. an increase in hepatic echogenicity as a reference, the presence of enhancement and lack of differenciation in the periportal intensity and the vascular wall due to great hyperechogenicity in the parenchyma. A cross-sectional relationship between NAFLD and metabolic syndrome with its individual components is evaluated.

Aims and objectives

The aims and objectives of the study are:
1. To study the prevalence of non-alcoholic fatty liver in metabolic syndrome; and
2. To study the correlation between the NAFLD and metabolic syndrome along with its individual components.

Materials and Methods

The study was conducted at Guru Gobind Singh Medical College and Hospital, Faridkot, Punjab, and 100 patients of metabolic syndrome were taken from OPD and indoor wards of the Medicine Department. Age and sex matched controls (100) were also be taken.

Inclusion criteria

- Patient fitting into criteria of metabolic syndrome
- Age more than 18 years.

Exclusion criteria

1. Patients less than 18 years and more than 65 years.
2. Patients with history of alcohol intake more than 30 grams/day in males and more than 20 grams/day in females.
3. Patients with history of jaundice or HBsAg positive and Hepatitis "C" positive.
4. Patients with history of following drug intake steroids, synthetic oestrogens, heparin, calcium channel blockers, amiodarone, valproic acid, arsenic, mercury, homeopathic drugs, ayurvedic drugs, antiviral agents.
6. Patients having autoimmune hepatitis.
7. History of drug abuse, opium, and nicotine.
8. Patients of Coronary artery disease.

Results

Total 100 cases were included in the study which met the criteria of metabolic syndrome and were subjected to USG abdomen. Detailed history, anthropometry, and clinical examination were done. All patients underwent various investigations including CBC, blood sugar, liver function test, HbsAg, anti HCV, and lipid profile. Fatty liver was defined as according to the standard criteria accepted by American Gastroenterology association, i.e. an increase in hepatic echogenicity as a reference, presence of enhancement and lack of differentiation in the periportal intensity, and vascular wall due to hyperechogenicity in the parenchyma. In total, 100 age and sex matched controls which did not have metabolic syndrome were taken, and various investigations and USG abdomen were done in controls also.

Out of 100 cases and 100 controls, 53 and 54 were females and 47 and 46 were males, respectively. Also, there is no statistically significant difference in the prevalence of fatty liver according to sex distribution.

Mean age in cases was 44.71 years and in controls was 46.15 years with SD of 10.27 and 14.17, respectively. No statistically

NCEP: ATPIII 2001 and IDF criteria for the metabolic syndrome			
NCEP: ATPIII 2001	**IDF Criteria for Central Adiposity**[a]		
Three or more of the following:	**Waist circumference**		
	Men	**Women**	**Ethnicity**
Central obesity: Waist circumference >102 cm (M), >88 cm (F)			
Hypertriglyceridemia: Triglycerides 150 mg/dL or specific medication	94 cm	80 cm	Europian, Sub-Saharan African, Eastern and Middle Eastern
Low HDL cholesterol: <40 mg/dL and <50 mg/dL, respectively, or specific medication	90 cm	80 cm	South Asian, Chinese, and ethnic South and Central American
Hypertension: Blood pressure 130 mm systolic or 85 mm diastolic or specific medication	85 cm	90 cm	Japanese
Fasting plasma glucose 100 mg/dL or specific medication or previously diagnosed Type 2 diabetes	Two or more of the following:		
	Fasting triglycerides >150 mg/dL or specific medication		
	HDL cholesterol <40 mg/dL and <50 mg/dL for men and women, respectively, or specific medication		
	Blood pressure >130 mm systolic or >85 mm diastolic or previous diagnosis or specific medication		
	Fasting plasma glucose 100 mg/dL or previously diagnosed Type 2 diabetes		

significant difference was seen in the prevalence of fatty liver in cases and controls.

Mean waist circumference of cases was 106 cm with standard deviation 7.29 and of controls 84 cm with standard deviation of 8.11. This observation was statistically significant [Table 1]. In total, 58.7% cases had reported increased waist circumference in a study done by Bajaj *et al.*,[9] and 47.1% cases had increased waist circumference in another study done by Duseja *et al.*[10] So central obesity was found to be associated with NAFLD.

Clinical and biochemical parameters of all cases and controls are shown in Table 1.

Mean SGOT levels were 34.16 IU in cases with SD of 17.02 and 30.88 IU in controls with SD of 14.0, and there is no statistically significant difference between the two values. Similarly, mean SGPT levels were 37.40 IU with SD 18.97 in cases and 36.05 IU with SD 22.76 in controls.

Mean triglyceride levels of cases was 255.64 mg/dl with SD 93.64. In controls, mean TG level was 156 mg/dl with SD 67.84. This observation is found to be statistically significant with Mann-Whitney *P* value. 000.

Hypercholesterolemia was present with mean cholesterol levels in cases were 221 ± SD 66.31, while in control group mean cholesterol levels were 183 ± SD 35.76 [Table 1]. This again is statistically significant.

Low serum HDL levels were seen in cases with mean HDL 42 ± SD 8.16. In control group, mean HDL levels were 46 ± 5.16. Bajaj *et al.*[9] had reported low HDL levels in 63.34% cases of fatty liver grade I and 85.71% cases of grade II fatty liver disease.

In controls, 62% of the cases were from rural background [Table 2] and 38% were from urban background. The prevalence of fatty liver in rural and urban population was 38% and 36% and that almost equal to overall prevalence in controls 38%. Among cases [Table 3], 59% belonged to rural background and 41% to urban background with the prevalence of fatty liver 72% and 73%, respectively. There is no statistically significant difference according to place of residence.

Out of 100 cases, 52 were hypertensive and 48 were non-hypertensive [Table 3]. Out of 52 hypertensive patients, 37 (71%) were having fatty liver. Among non-hypertensive cases, 36 (75%) were having fatty liver most probably due to other components of metabolic syndrome. Among controls, 6 were having HT and only 1 (16%) person was having fatty liver.

Out of 100 cases [Table 3], 23 were diabetic and 5 persons among controls were also suffering from diabetes, and the prevalence of fatty liver in diabetic cases was 14 (43%) and in controls 3 (60%). Diabetes is also a risk factor for progressive fibrosis. In a study done by Kaushal *et al.*, 9% patients of NAFLD were having diabetes and 63.8% were having impaired fasting glucose.[11]

Discussion

Metabolic syndrome includes central obesity, type 2 DM, dyslipidaemia, and hypertension which are established risk factors for cardio vascular abnormalties such as mayocardial infarction and CAD but association between metabolic syndrome and fatty liver is not known much.

Mean age group of non-metabolic syndrome controls was 46.15 years with SD 14.17 and that of metabolic syndrome cases was 44.71 years with SD 10.27. So cases of controls were comparable. Mean age group is slightly higher in our study to that reported by Bajaj *et al.*[9] (40.11 ± 1.1).

Metabolic syndrome patients had hypertriglyceridaemia (>150 mg/dl) with a mean of 255.64 mg/dl with SD 93.65 as compared to non-metabolic syndrome patients who have Triglyceride mean as 156.64 mg/dl with SD of 67.9. Bajaj *et al.* had reported 23.1% of patients of NAFLD had hypertriglyceridaemia.

Deranged SGOT and SGPT was observed in metabolic syndrome cases. Mean SGOT was 34.16 with SD of in cases and in controls. Similarly, mean SGPT levels were in cases and in controls. But it is not statistically significant.

Type 2 DM is also a major component of metabolic syndrome. In our study, mean Fasting plasma glucose level in cases was 128.76 mg/dl ± 45.64 mg/dl and 95.76 mg/dl ± 34.54 mg/dl in controls. Out of 100 cases, 23% were diabetic and 5 persons among controls were also suffering from diabetes and the prevalence of fatty liver in diabetic cases was 14 (43%) and in controls 3 (60%). So diabetes as a single factor can be associated

Table 1: Clinical and biochemical parameters of all cases and controls			
	Metabolic Syndrome (Cases)	**Non Metabolic syndrome (Controls)**	**Mann Whitney U Test**
Age	44.71±SD 10.271	46.15±SD 14.169	0.750
Waist circumference	106.51±7.291	84.86±8.114	0.000
SGOT	34.16±17.026	30.88±14.00	0.175
SGPT	37.40±18.97	36.05±22.76	0.222
S. Cholesterol	221.85±66.312	183.76±35.762	0.000
Triglycerides	255.64±93.649	156.64±67.845	0.000
HDL Cholesterol	42.877±8.165	46.050±5.166	0.000

The significance level id is 0.05

Table 2: Distribution of NAFLD in relation to residence, hypertension, and diabetes in controls

	USG Finding Fatty Liver	Normal scan
Residence Rural	24	38
Urban	14	24
Hypertension No	37	57
Yes	1	5
Diabetes no	35	60
Yes	3	2

Table 3: Distribution of NAFLD in relation to residence, hypertension, and diabetes in cases

	USG Fatty Liver	Normal scan
Residence Rural	43	16
Urban	30	11
Hypertension no	36	12
Yes	37	15
Diabetes Yes	14	9
No	59	18

Table 4: Distribution of fatty liver with and without metabolic syndrome

	USG Fatty Liver	Normal scan
Metabolic Syndrome cases	73	27
Controls	38	62

with fatty liver. Diabetes is also a risk factor for progressive fibrosis. In a study done by Kaushal *et al.*, 9% patients of NAFLD were having diabetes and 63.8% were having impaired fasting glucose.[11]

Out of 100 cases, 52 were hypertensive and 48 were non-hypertensive. Out of 52 hypertensive patients, 37 (71%) were having fatty liver. Among controls, 6 were having hypertension and only 1 (16%) person was having fatty liver. Bajaj *et al.* had reported 71.42% cases of hypertension had Grade III fatty liver and 23.34% cases of hypertension had Grade II fatty liver.

Odds Ratio = 4.4

In total, 73% cases of metabolic syndrome according to NCEP ATPIII were having fatty liver [Table 4], while in controls, 38% persons were having fatty liver which is statistically significant. Similar findings were found by Ajay Duseja *et al.* (50%). In an another study, Deepa Uchil *et al.*[12] had described the prevalence of fatty liver to be 47.1%. Also, 90.0% and 33% NAFLD persons are found to be having at least one feature and all features of metabolic syndrome, respectively, thus increasing the risk of NAFLD to 4-11 times. Recently, a study done by Mukesh S. Paudel[13] in three different sites in and around Butwal sub metropolitan city of Rupandehi District Nepal concluded that 57.6% participants of non-alcoholic fatty liver were having metabolic syndrome and 91.4% participants of radiological fatty liver were having at least one component of metabolic syndrome.

In our study, odds ratio was found to be 4.4. This is in line with another study done by Bashu Dev Parde *et al.*[14] in Nepal in 2018. They concluded that according to NCEP ATPIII criteria 13.6% of NAFLD were present with metabolic syndrome, where the risk estimate was significant (OR 2.15). Thus, a conclusion can be drawn that metabolic syndrome along with its individual components has greater association with fatty liver disease.

Conclusion

From the above observations, we can conclude that there is high prevalence of fatty liver in metabolic syndrome patients. Fatty liver is mostly asymptomatic in early stages or patients present with non-specific symptoms of abdominal fullness or dyspepsia. We can detect fatty liver if we have high suspicion of it in metabolic syndrome patients. Metabolic syndrome diagnosis can be established from clinical and biochemical parameters, and some of the components of metabolic syndrome like waist circumference are modifiable with life style modifications. Reducing weight also helps in controlling diabetes, hypertension, hypercholesterolaemia, and hypertriglyceridaemia. Changes in the liver are reversible when there is only steatosis.

So in primary care setting, we easily diagnose metabolic syndrome based on clinical and biochemical parameters, thus establishing the risk for fatty liver. We can apply primary prevention by introducing life style modifications, thus modifying the disease course and delaying more serious complications like Cirrhosis of Liver and Hepatocellular Carcinoma.

Conflicts of interest
There are no conflicts of interest.

References

1. Farrell GC, Larter CZ. Nonalcohlic fatty liver disease: From steatosis to cirrhosis. Hepatology 2006;43:500-12.
2. Castellares C, Barreiro P, Martín-Carbonero L, Labarga P, Vispo ME, Casado R, *et al*. Liver cirrhosis in HIV infected patients: Prevalence, etiology and clinical outcome. Viral Hepat 2008;15:165-72.
3. Haring R, Wallaschofski H, Nauck M, Dörr M, Baumeister SE, Völzke H. Ultrasonographic hepatic steatosis increases prediction of mortality risk from elevated serum gamma-glutamyl transpeptidase levels. Hepatology 2009;50:1403-11.
4. Zhou ZJ, Li YY, Nie YQ, Ma JX, Lu LG, Shi SL, *et al*. Prevalence of fatty liver disease and its risk factors in the population of South China. World J Gastroenterol 2007;13:6419-24.
5. Fukuda T, Hamaguchi M, Kojima T, Ohshima Y, Ohbora A, Kato T, *et al*. Association between serum gamma glutamyl transpeptidase and atherosclerosis: A population based cross sectional study. BMJ Open 2014;4:e005413.
6. Ratziu V, Bellentanib S, Cortez-Pinto H, Day C, Marchesini G.

A position statement on NAFLD/NASH based on EASL 2009 special conference. J Hepatol 2010;53:372-84.

7. Singh SP, Nayak S, Swain M, Rout N, Mallik RN, Agrawal O, *et al.* Prevalence of nonalcoholic fatty liver disease in coastal Eastern India: A preliminary ultrasonographic survey. Trop Gastroenterol 2004;25:76-9.

8. Mohan V, Farooq S, Deepa M, Ravikumar R, Pitchumoni CS. Prevalence of nonalcoholic fatty liver disease in urban south Indians in reation to different grades of glucose tolerance and metabolic syndrome. Diabetes Res Clin Pract 2009;84:84-91.

9. Bajaj S, Nigam P, Luthra A, Pandey RM, Kondal D, Bhatt SP, *et al.* A case control study on insulin resistance, metabolic co variates and prediction score in nonalcoholic fatty liver disease. Indian J Med Res 2009;129:285-92.

10. Duseja A, Das A, Das R, Dhiman RK, Chawla Y, Bhansali A, *et al.* The clinicopathological profile of Indian patients with nonalcohlic fatty liver disease (NAFLD) is different from that of in the West. Dig Dis Sci 2007;52:2368-74.

11. Kaushal M, Batra Y, Gupta S, Chander B, Rajan KD, Tewatia MS, *et al.* Non alcoholic fatty liver disease may not be a severe disease at presentation among Asian Indians. World J Gastroenterol 2006;12:3400-5.

12. Uchil D, Pipalia D, Chawla M, Patel R, Maniar S, Narayani, *et al.* Non-alcohlic fatty liver disease (NAFLD) – The hepatic component of metabolic syndrome. J Assoc Physicians India 2009;57:201-4.

13. Paudel MS, Tiwari A, Mandal A, Shrestha B, Kafle P, Chaulagai B, *et al.* Metabolic syndrome in patients with non –alcohlic fatty liver disease. A community based cross sectional study. Cureus ;11:e4099.

14. Pardhe BD, Shakya S, Bhetwal A, Mathias J, Khanal PR, Pandit R, *et al.* Metabolic syndrome and biochemical changes among non-alcohlic fatty liver disease patients attending a tertiary care hospital of Nepal. BMC Gastroenterology 2018;18:109.