Carotid Intima-Media Thickness in Patients with Non-Alcoholic Fatty Liver Disease

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Abstract: *Objective*: To measure the thickness of Carotid Intima Media (CIMT) in patients with Non-Alcoholic Fatty Liver Disease (NAFLD) and compare it with Controls, to establish the strong association of NAFLD with increased CIMT.

Method/Setting: Fifty four patients with sonographically proven NAFLD and 50 controls were examined for CIMT. Carotid scanning was performed on Aloka 3500 Doppler Unit.

Results: The mean Intima Media Thickness in NAFLD group was 0.80±0.12 and in controls 0.58±0.15 (p= <0.0001). Carotid plaque was found in 24.07% patients in NAFLD group.

Conclusion: NAFLD as an independent risk factor for atherosclerosis and cardiovascular disease. Measurement of CIMT is a reliable, non-invasive tool for early detection of atherosclerosis in these patients.

Keywords: Non-Alcoholic Fatty Liver Disease (NAFLD), Carotid Intima Media Thickness (CIMT).

INTRODUCTION

Carotid Intima Media Thickness (CIMT) is a useful tool for detection of sub-clinical atherosclerosis. It therefore, not only indirectly indicates the presence of coronary atherosclerosis but also gives some estimation of its severity [1, 2].

Non-Alcoholic Fatty Liver Disease (NAFLD) is one of the most common liver diseasesreported all over the world and the disease spectrum ranges from simple steatosis to non-alcoholic steato-hepatitis to cirrhosis [3]. Fatty liver, the common term used for NAFLD has strong association with metabolic syndrome. Obesity, type-2 diabetes, dyslipidemia and insulin resistance is therefore evident in most of these patients [4]. As there is a clear association of fatty liver disease being a part of spectrum of metabolic syndrome, several studies have been conducted to establish NAFLD as an independent risk factor for atherosclerosis and cardiovascular disease [4, 5].

The CIMT is considered to be a non-invasive marker for atherosclerosis and the thickness is directly proportional to the presence ofatherosclerosis in the coronary vessels and the severity of cardiovascular disease [6, 7].

The aim of our study is to determine the relationship between NAFLD and CIMT by comparing the CIMT of patients with sonographically proven NAFLD with a group of patients having normal echogenicity of liver parenchyma on ultrasound.

MATERIALS & METHODS

Fifty patients withNAFLD confirmed on abdominal ultrasound and 50 controls with normal liver parenchyma underwent carotid artery ultrasonography for measurement of CIMT and detection of atherosclerotic plaque. All subjectsaged between 40 and 50 years.

CIMT is defined as the distance between the leading edge of the first echogenic line (lumen-intima interface) and the second echogenic line (media-adventitia interface) of the anterior and posterior arterial walls.

Carotid plaque is defined as a focal thickening greater than 1.2 mm of the intima-media complex, measured from the media-adventitia interface to the intima-lumen interface. Carotid artery ultrasonography was performed using a 10 MHz high frequency linear transducer on the Aloka 3500 Doppler unit. Examination was performed in supine position with pillow under shoulders and neck tilted opposite to the site of examination to open up the anterior triangle of neck. Examination included sections of approximately 2-3 cm of common carotid artery just below the carotid bulb. After localizing the carotid arteries by transverse scan,a longitudinal image was obtained and recorded by rotating the probe. Thickness of Intima Media was measured vertical to the arterial wall. Three readings

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Table 1: Patients' Characteristics and CIMT in NAFLD and Controls

VARIABLES	NAFLD	CONTROL
Total number of patients	54	50
Males	33	28
Females	21	22
Mean CMIT	0.80±0.12	0.58±0.15
Males	0.82±0.14	0.59±0.14
Females	0.79±0.16	0.57±0.13
BMI (kg/m^2)	27.5	26

were recorded at each site and the average measurement was used. All the scans were performed by a single sonographer to maintain uniformity.

Hepatic Steatosis is defined as the presence of ultrasonographic pattern of parenchymal brightness of liver. It is graded as grade 1 to 3. Grading is as follows:

Grade 1 (mild): Minimallyincreased echogenicity with normal appearance of the diaphragm and intra-hepatic vessels.

Grade 2 (moderate): Moderately increased echogenicity with minimally altered appearance of diaphragm or intra-hepatic vessels.

Grade 3 (severe): markedly increased echogenicity with poor visualization of diaphragm, intra-hepatic vessels and posterior portion of the right lobe. Complete loss of echogenicity of the wall of portal vein.

Patients with Diabetes mellitus, heart disease, hypertension, known dyslipedemias, history of chronic liver disease, hepatitis B or C virus infection, acute or chronic kidney disease, pregnancy or any malignancy were not included in the study. Cigarette smokers, alcoholics and those taking any medications like oral contraceptives were also excluded.

Data was analyzed on SPSS 20.0 and results were compared for the two groups.

RESULTS

We assessed 54 patients with NAFLD (33 males, 21 females) and 50 controls (28 males, 22 females). The mean patient age in NAFLD group was 47.5 years while it 46.7 years in the control group. Mean body mass index (BMI) of NAFLD group was higher as compared to the controls. In NAFLD group 14 (25.9%) had grade 3 hepatic steatosis while grade 1 and 2 hepatic steatosis was present in 12 (22.2%) and 28 (51.8%) patients respectively.

Mean CMIT in NAFLD group was 0.80±0.12 mm as compared to 0.58±0.15 mm in controls (p= <0.0001) (Table **1**).

In NAFLD group majority (59.25%) of patients were hypertensive while in the control group 22% patients had history of hypertension.

The mean BMI in NAFLD group was 27.5 kg/m^2 while in control it was 26.0 kg/m^2.

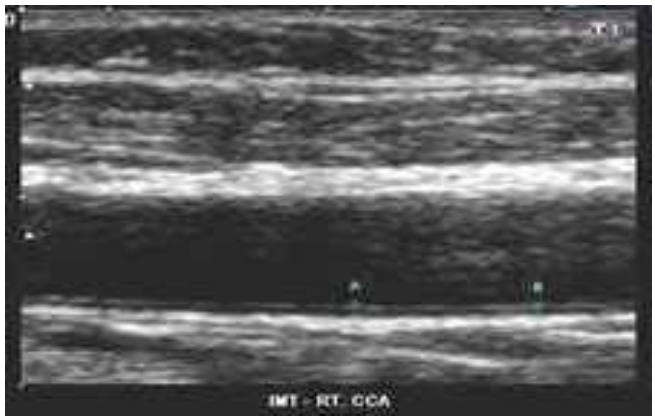

Figure 1: Sonographic appearance of Carotid Intima Media Thickness.

DISCUSSION

Non-alcoholic fatty liver disease is a common disorder seen in clinical practice. Its strong association with metabolic syndrome and atherosclerosis has made it an interesting subject for research [8]. Increased CMIT is a reliable indicator of atherosclerosis burden and a good predictor of cardiovascular disease. In several clinical trials, The Intima Media Thickness was measured to determine the harmful effects of risk factors on vessel wall. Many researchers have proved that treating the risk factors

decreases the progression of the IMT and there is a parallel reduction in cardiovascular risks and events [9, 10].

We measured the thickness of carotid intima media in patients with fatty liver on ultrasound. Previous many studies on the same topic also employed ultrasound as a reliable tool for the diagnosis of fatty liver [4, 11-13].

The prevalence of fatty liver disease increases progressively from normal weight subjects to obese subjects [14-16]. In our study also the average BMI in NAFLD group was 27.5 kg/m^2.

The mean CMIT in NAFLD group in our study was 0.80±0.12 while it was 0.58±0.15 in the control group (p= 0.0001). These values clearly show a strong relationship between hepatic steatosis and increased thickness of carotid intima media. The results are consistent with similar studies conducted earlier [11, 12, 16, 18].

Two studies explained the relationship between CIMT and NAFLD in type-2 diabetic patients with insulin resistance [13, 19].

In the present study, we could not prove the strong association of carotid plaque with NAFLD (24.07%). However previous many studies have proven the strong possibility of a carotid plaque in patients with hepatic steatosis [11, 17, 20]. Majority of our patients in NAFLD group were hypertensive. This finding could very well be explained on the basis of metabolic syndrome. The patients with metabolic syndrome have a higher incidence of fatty liver disease and atherosclerosis [20-22].

CONCLUSION

Hepatic steatosis is a reliable marker of increased CMIT. Since, IMT is a good predictor of cardiovascular disease, all patients having fatty liver on ultrasound should also be scanned for carotid lesions. This simple and non-invasive practice will help in early diagnosis of cardiovascular disease, especially in overt cases.

REFERENCES

[1] Raitakari OT, Juonala M, Kähönen M, Taittonen L, Laitinen T, *et al*. Cardiovascular risk factors in childhood and carotid artery intima-media thickness in adulthood: the cardiovascular risk in young Finns study. JAMA 2003; 290(17): 2277-83. http://dx.doi.org/10.1001/jama.290.17.2277

[2] Kim JH, Kim SY, Jung ES, Jung SW, Koo JS, *et al*. Carotid Intima-Media Thickness Is Increased Not Only in Non-Alcoholic Fatty Liver Disease Patients but Also in Alcoholic Fatty Liver Patients. Digestion 2011; 84: 149-55. http://dx.doi.org/10.1159/000326854

[3] Preiss D, Sattar N. Non-alcoholic fatty liver disease: an overview of prevalence, diagnosis, pathogenesis and treatment considerations. ClinSci (Lond) 2008; 115(5): 141-50. http://dx.doi.org/10.1042/CS20070402

[4] Caserta CA, Pendino GM, Amante A, Vacalebre C, Fiorillo MT, *et al*. Cardiovascular risk factors, nonalcoholic fatty liver disease, and carotid artery intima-media thickness in an adolescent population in southern Italy. Am J Epidem 2010; 171(11): 1195-202.

[5] Ramilli S, Pretolani S, Muscari A, Pacelli B, Arienti V. Carotid lesions in outpatients with nonalcoholic fatty liver disease. World J Gastroenterol 2009; 15(38): 4770-74.

[6] de Groot E, Hovingh GK, Weigman A, *et al*. Measurement of arterial wall thickness as a surrogate marker for atherosclerosis. Circulation 2004; 109(23): III33-III38.

[7] Gansso A, Irace C, Mattioli PL, *et al*. Carotid intima media thickness and coronary heart disease risk factors. Atherosclerosis 1996; 119(1): 7-15.

[8] Kilciler G, Genc H, Tapan S, Ors F, Kara M, *et al*. Mean platelet volume and its relationship with atherosclerosis in subjects with non-alcoholic fatty liver disease. Upsala J Med Sci 2010; 115: 253-59. http://dx.doi.org/10.3109/03009734.2010.500062

[9] Salonen JT, Salonen R. Ultrasound B mode imaging in observational studies of atherosclerotic progression. Circulation 1993; 87(3): II56-58. http://dx.doi.org/10.1056/NEJM199901073400103

[10] O'Leary DH, Polak JF, Kornmal RA, Manolio TA, Burke GL, *et al*. Carotid artery intima and media thickness as a risk factor for myocardial infarction and stroke in older adults. Cardiovascular Health Study Collaborative Research Group. N Engl J Med 1999; 340: 14-22.

[11] Palmentieri B, de Sio I, La Mura V, Masarone M, Vecchione R, *et al*. The role of bright liver echo pattern on ultrasound B-mode examination in the diagnosis of liver steatosis. Dig Liver Dis 2006; 38: 485-89. http://dx.doi.org/10.1016/j.dld.2006.03.021

[12] Carallo C, Mancuso G, Mauro G, Laghi F, Madaferri B, *et al*. Hepatic steatosis, carotid atherosclerosis and metabolic syndrome: The STEATO study. J Gastroenterol 2009; 44: 1156-61.

[13] Targher G, Bertolini L, Padovani R, Rodella S, Zoppini G, *et al*. Relations between carotid artery wall thickness and liver histology in subjects with nonalcoholic fatty liver disease. Diabetes Care 2006; 29: 1325-30. http://dx.doi.org/10.2337/dc06-0135

[14] Collichio P, Tarantino G, delGenio F, *et al*. Non-alcoholic fatty liver disease in young adult severely obese non-diabetic patients in South Italy. Ann Nutr Metab 2005; 49(5): 289-95.

[15] Quiros-Tejeira RE, Rivera CE, Zibba TT, *et al*. Risk for non-alcoholic fatty liver disease in Hespanic youth with BMI ≥95th percentile. J Pediatr Gastroenterol Nutr 2007; 44(2): 228-36.

[16] Mohamadi A, Ghasemi-Rad M, Zahedi H, Toldi G, Alinia T. Effect of severity of steatosis as assessed ultrasonographically on hepatic vascular indices in non-alcoholic fatty liver disease. Med Ultrason 2011; 13(3): 200-6.

[17] Mohammadi A, Bazzazi A, Ghamesi-Rad M. Evaluation of atherosclerotic findings in patients with nonalcoholic fatty liver disease. Int J Gen Med 2011; 4: 717-22. http://dx.doi.org/10.2147/IJGM.S25753

[18] Poanta IP, Albu A, Fodor D. Association between fatty liver disease and carotid atherosclerosis in patients with uncomplicated type 2 diabetes mellitus. Med Ultrasonogr 2011; 13(3): 215-9.

[19] Petit JM, Guiu B, Terriat B, Loffroy R, Robin I, *et al*. Non-alcoholic fatty liver disease is not associated with carotid intima-media thickness in type 2 diabetic patients. Clin Endocrinol Metab 2009; 94: 4103-6. http://dx.doi.org/10.1210/jc.2009-0541

[20] Vlachopoulos C, Manesis E, Baou K, Papatheodoridis G, Koskinas J, *et al*. Increased arterial stiffness and impaired endothelial function in non-alcoholic fatty liver disease:A Pilot Study. Am J Hypertension 2010; 23(11): 1183-89.

[21] Koskinen J, Magnussen CG, Kahonen M, Loo B, Marniemi J. Association of liver enzymes with metabolic syndrome and carotid atherosclerosis in young adults. The cardiovascular risk in Young Finns Study. Ann Med 2011; 1-9.

[22] Persighin G. The role of non-alcoholic fatty liver disease in Cardiovascular disease. Dig Dis 2010; 28: 210-13. http://dx.doi.org/10.1159/000282088

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