

Correlating Coronary Artery Disease and Non-Alcoholic Fatty Liver among a Sample of the Egyptian Population, Using Multislice CT

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Abstract

Purpose: To evaluate the relationship between Nonalcoholic Fatty Liver Disease (NAFLD) and Coronary Artery Disease (CAD).

Material and Methods: Thirty patients with low to intermediate risk for CAD having NAFLD were included and thirty other individuals of matched age, sex and risk factors without NAFLD were served as controls. Fatty liver was diagnosed using non contrast CT study when the calculated attenuation value of the liver is less than that of the spleen by 10 HU. The coronary arteries were assessed using CT angiography, significant CAD was defined as a stenosis of more than 50% in at least one major coronary artery. Statistical analysis was performed to study associations.

Results: Significant correlation between the NAFLD and the presence of coronary artery disease (this included the significant and non significant lesions), yet there was no significant correlation between presence of NAFLD and the presence of significantly stenotic lesions.

Conclusion: In Egyptian population NAFLD may be considered as a predictor for coronary atherosclerosis yet not, a predictor for significant CAD.

Key Words: MSCT coronary angiography – Non-alcoholic fatty liver disease – Coronary artery disease – Atherosclerosis.

Introduction

NON-ALCOHOLIC fatty liver disease (NAFLD) is recognized as one of the most common liver disorder in Western countries, with a prevalence of 15%-20% among the population, increasing to reach 70%-90% in obese or type 2 diabetic patients [1].

Atherosclerosis risk factors, like obesity, diabetes and dyslipidemia, are frequently associated

with NAFLD [2]. So, it can show a possible role in development of atherosclerosis. Few studies have investigated the association between NAFLD and CAD in patients with low cardiovascular risk factors [3]. Evaluating the role of NAFLD in the development of CAD will allow detection of cases with subclinical CAD [4].

Ultrasound (US) is widely used to help detect fatty liver but may provide contradictory results. Un-enhanced Computed Tomography (CT) is an accurate imaging modality to detect and characterize hepatic steatosis [2].

The gold standard for diagnosis of CAD is the conventional coronary angiography, however, it is invasive and may be associated with complications. In addition, it provides little information on the early atherosclerotic wall changes that occurs in the coronary artery disease. Multislice CT coronary angiography has been introduced as a non invasive modality to detect coronary atherosclerosis and classify coronary artery disease [5]. It can evaluate the vessel wall, visualize calcified and non calcified plaques and assess the degree of luminal narrowing [6].

Multiple studies showed that coronary CTA has a high negative predictive value for the detection of coronary atherosclerosis; more than 95% for significant stenosis and about 90% for any plaque [7].

The aim of this study is to evaluate the coronary arteries using MSCT in a sample of the Egyptian population having NAFLD compared to non fatty liver population and to find an association between NAFLD and CAD as a possible predictor for CAD.

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Patients and Methods

All patients were examined in the period between March 2011 and January 2014, using the multislice CT scanner; Somatom Definition Dual-Source 64 Slice, Siemens AG, Germany, in Cairo Scan Radiology Center.

Eighty five patients were enrolled in the study, 50 patients with recent chest pain, 23 patients with dyspnea and 12 patients with palpitation.

From the evaluated 85 patients, 30 patients were diagnosed with NAFLD (on CT basis) were included in Group (A), this group included 20 males and 10 females with mean age = 49.5 ± 7.7 Sd. Of those 55 patients that did not have NAFLD, 30 patients were selected to be included in the control Group (B) with consideration of their age and sex and other risk factors to match with Group (A) to limit the bias of other risk factors. Group B also included 20 males and 10 females with mean age = 49.4 ± 17.8 SD.

Exclusion criteria were: Patients with diagnosed ischemic heart disease or coronary revascularization, cerebrovascular disease, severe obesity (BMI of 35 or more) and patients taking drugs that may induce hepatic steatosis.

Specific exclusion criteria for coronary CT include: Irregular heart rate or tachycardia despite therapy, severe lung disease, history of allergic reaction to iodine-containing contrast agents and renal impairment.

The study was approved by the local ethical committee, and all patients agreed to participate in the study.

Clinical presentation and laboratory data were obtained, only results within the last 6 months were considered.

Non enhanced CT scan was performed through the chest (ECG-gated) to detect and quantify the coronary calcifications and through the abdomen to measure the density at the liver and spleen, three Regions of Interest (ROI) were placed in the liver and spleen (avoiding the sites of vessels) and their average were calculated. Fatty liver is considered when splenic-hepatic density is > 10 HU.

The CT angiography studies of the coronary arteries were performed according to the following protocol:

B-blocker (10mg of Propranolol), was given orally if the resting heart rate was more than 70 beats per minute. The patient was imaged in the

supine position. A bolus of 70-90ml of Iopromide (370mg of iodine per milliliter, Ultravist; Bayer, Germany) was injected intravenously at a rate of 5mL/sec followed by a 50-mL bolus of saline via an 18-gauge catheter placed in the antecubital vein.

Scan delay was determined by employing an automatic bolus test in which the ROI was located on the ascending aorta. Patients were instructed to maintain an inspiratory breath hold while CT data were acquired.

A CT examination with a section thickness of 0.625 mm was obtained. Retrospective ECG gating was used with gantry rotation of 350msec. Temporal resolution was 83msec. Pitch and tube currents of 200-500mA were determined according to the patient's weight.

Raw image data sets were analyzed. Images reconstruction was performed with 0.6-mm section thickness; 0.3-mm overlap producing to obtain curved multiplaner reformatted and volume rendering images.

Plaques were classified as calcified, non calcified and mixed plaques. The degree of stenosis was considered significant if more than 50% caliber attenuation was present.

Statistical analysis and data management:

Patients are classified to Group A with NAFLD and Group B as a control group. Statistical correlation between presence of fatty liver and coronary artery atherosclerosis was done. Also statistical correlation between presence of risk factors (involved in the study) and CAD was evaluated. The data was analyzed with the program (SPSS) statistical package for social science version 16.

Results

The study population were 85 patients; 30 patients were diagnosed with NAFLD and included in Group (A) (20 males and 10 females) with mean age= 49.5 ± 7.7 SD.

Of the 55 patients that did not have NAFLD, 30 patients were selected to be included in the control Group (B) considering the age, sex and other factors to match with the Group (A) to limit the bias of the other risk factors. The Group B included 20 males and 10 females with mean age = 49.4 ± 17.8 SD.

The correlation between NAFLD group (Group A), control group (Group B) and the presence of coronary atherosclerosis including presence coronary calcifications, non calcified plaques, with or

without significant CAD is evaluated and shown in (Table 1).

Table (1): Showing correlation between NAFLD and presence of all forms of coronary atherosclerosis.

	Group		Total
	(A)	(B)	
No. of patients with no CAD	13	20	33
Their % within group	43.3%	66.7%	55.0%
No. of patients with CAD	17	10	27
Their % within group	56.7%	33.3%	45.0%

Patient with fatty liver (Group A) who developed coronary atherosclerosis (this included the significant and non significant coronary artery disease) were 17 (56.7%) while patients from control group (Group B) who developed coronary atherosclerosis were 10 (33.3%) and this was statistically significant $p=0.049$.

The number of patient with NAFLD who developed significant CAD was 9 (30%) while the

number of control patients who developed significant CAD was 6 (20%) and this was statistically insignificant $p=0.276$.

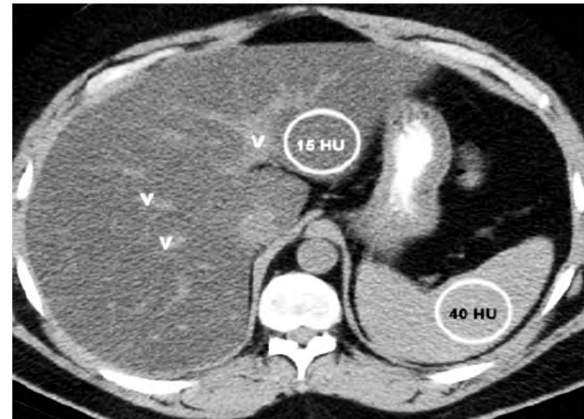


Fig. (1): Diffuse fat accumulation in the liver at unenhanced CT. The attenuation of the liver (15 HU) is significantly lower than that of the spleen (40 HU). Intrahepatic Vessels (v) appear hyper-attenuated in comparison with the liver [8].



Fig. (2): (A): Non obstructive coronary artery disease involving the LAD is a male patient 52 years old with NAFLD. (B): Significantly stenotic lesion at the proximal LAD segment in a male patient 36 years old, also with NAFLD.

Discussion

Volzke et al., [9] reported that there is an association between carotid atherosclerotic plaques and hepatic steatosis. They suggested that it is possibly attributed to the metabolic changes associated with nonalcoholic fatty liver.

Possible pathways correlating CAD and NAFLD include increased oxidative stress, sub-clinical inflammation, endothelial dysfunction and serum lipid abnormalities [10].

We evaluated the correlation between NAFLD and coronary atherosclerosis in a small sample of the Egyptian individuals. We used non enhanced CT for evaluation of fatty liver using the splenic

density as a reference. When the liver density decreased by 10 HU or more, this was diagnostic for fatty infiltration of the liver. This method has a high sensitivity (88%-95%) and specificity (90%-99%) [11].

We found that there is a significant correlation between the NAFLD and the presence of coronary artery disease (this included the significant and non significant lesions), yet there was no significant correlation between presence of NAFLD and the presence of significantly stenotic lesions.

Assy et al., [4] used the non enhanced CT for diagnosis of fatty liver and used coronary CTA for evaluation of presence of coronary plaques, they concluded that patients with NAFLD have higher

prevalence of non calcified coronary plaques and this matches with our results.

Our results also matched with Lee et al., [12], who reported that there is correlation between NAFLD and the coronary calcifications. They also tried to define the correlation between the extent of NAFLD and the coronary calcium score. They found that fatty liver disease may serve as an independent factor even after adjustment of clinical variables and estimated cardiovascular risk scores.

In conclusion, fatty liver disease can be considered as a predictor for coronary atherosclerosis and so, more individuals from the general population with subclinical CAD could be detected at earlier stages when fatty liver is identified.

Limitations:

The study is a nonrandomized study that included patients who planned to undergo coronary CT angiography in a given period of time. The incidence of CAD was low (45%) and furthermore; the significant CAD was less (25%) in the study population because we excluded the patients with high susceptibility of having significant CAD. Also we did not grade the degree of fatty liver and this was not correlated with the severity of CAD.

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الملخص العربي

مرض الكبد الدهني غير المرتبط بتعاطي الكحول من الأمراض المنتشرة وهو يشترك مع أمراض تصلب الشرايين في مسبباتها. ولذلك، فقد قامت فكرة البحث على دراسة ما إذا كان هناك ارتباط بين الكبد الدهني غير المرتبط بتعاطي الكحول وتصلب الشرايين التاجية. شملت الدراسة ٣٠ مريضاً بالكبد الدهني غير المرتبط بتعاطي الكحول و ٣٠ مريضاً لا يعانون المرض بنفس السن والجنس وبنفس احتمالات التعرض الأخرى للأمراض تصلب الشرايين.

وقد خضع جميع المرضى لفحص الأشعة المقطعية بدون صبغة أولاً لتشخيص الإصابة بالكبد الدهني ثم بالصبغة على شرايين القلب لتحديد مدى إصابتها بالتصلب.

وقد أظهرت الدراسة وجود ارتباط بين الكبد الدهني غير المرتبط بتعاطي الكحول والإصابة بتصلب الشرايين التاجية عموماً عند المصريين وإن كانت أظهرت أيضاً عدم ارتباط الإصابة بوجود ضيق مؤثر بالشرايين التاجية.