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Original article

Study about Frequency of Carotid Intima- Media Thickness versus Aortic Intima- Media Thickness in Patients with Non Alcoholic Fatty Pancreatic Disease

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Abstract

Background: Non-alcoholic fatty pancreatic disease (NAFPD) or fatty pancreas emerged as health problem parallel to obesity. NAFPD can lead to diabetes mellitus, chronic pancreatitis and lastly pancreatic cancer. Extra pancreatic complications to cardio-vascular system are reported to more than expected. **Aim:** To investigate the association between carotid and aortic intima-media thickness and non-alcoholic fatty pancreas disease. **Method**: eighty-eight patients divided into 4 groups , group (1)diabetics with normal Body Mass Index(BMI) , group (2) diabetics with BMI over 25 kg/m^2 , group(3) non-diabetics with normal BMI , group (4) non diabetics with BMI over 25kg/m^2 . All routine investigations necessary done including, Complete Blood Count (CBC), fasting blood sugar , HbA1c%, liver profile including (ALT , AST , GGT , ALP , serum bilirubin and serum albumin) , lipid profile including (cholesterol , triglycerides , HDL , and LDL) , serum insulin level . Abdominal ultrasound for diagnosis, grading of fatty pancreas and measure Cartotid Intima Media Thickness(CIMT) and Aortic Intima Media Thickness (AIMT). **Result:** AIMT was as follow (0.96-+0.26) for healthy normal ,(1.38-+0.20)for non DM –obese,(1.24-+0.18)DM , non-obese and (1.52-+0.37) for DM –obese patients respectively with p value between the groups =<0.001.CIMT was as follow (0.58-+0.18) for healthy normal ,(0.73-+0.18)for non DM –obese,(0.86-+0.20)DM , non-obese and (1.01-+0.25) for DM –obese patients respectively with p value between the groups =<0.001 **Conclusion:** Both AIMT and CIMT manifested in the patients groups even the normal healthy subjects which is

alarm sign for health care providers to take care.

Keywords: Obesity, Aortic Intimal Media Thickness (AIMT) , Carotid Intima Media Thickness(CIMT) and Non Alcoholic Fatty Pancreas Disease (NAFPD)

Introduction

As a worldwide health issue, obesity has significant public health effects (1). High BMI has more than doubled in frequency for both men and women, according to the Global Burden of Disease Study (GBD), resulting in 2.4 million deaths in women and 2.3 million deaths in men (2).

Numerous life-threatening illnesses have been linked to obesity, most notably the metabolic syndrome, which encompasses type 2 diabetes, heart disease, and cancer (3).

Type 2 diabetes is characterized by insulin resistance and -cell dysfunction. Risk factors for insulin resistance include excessive visceral adipose tissue (VAT) accumulation and ectopic lipid deposition in muscle and liver (4). Insulin secretion was shown to be negatively associated with the amount of fat found within the pancreas. Pancreatic fatty load plays an important role in the development of cell dysfunction, as shown by this study's findings (5).

An excessive buildup of lipids in the pancreas is referred to as NAFPD (non-alcohol fatty pancreatic disease). It's unclear what pancreatic fat accumulation would mean compared to non-alcoholic fatty liver disease (6).

Pancreatic acinar cells and islets are directly harmed by the toxic action of fat on pancreatic acinar cells and islets when fat is infiltrated into the pancreas (7). Following pancreaticoduodenojejunostomy surgery, patients with fatty pancreases may be more likely to develop pancreatic fistulas (PF), which may lead to pancreatic cancer progression (5&8).

Diagnostic criteria for subclinical atherosclerosis have been developed using carotid intima-media thickness (CIMT). Individuals with a high risk of cardiovascular disease might utilize this method to identify early functional and structural changes in the blood vessel walls (9 & 10).

Preclinical atherosclerosis in individuals with type 1 diabetes may be detected with greater sensitivity by measuring the intima-media thickness of the aortic artery rather than the carotid artery (11).

In the present investigation, we aimed to investigate the association between carotid and aortic intima-media thickness and non-alcoholic fatty pancreas disease

Patients and Methods

In El-Helal Health Insurance Hospital in Shebin El –Kom in period from 2019 to 2021, a total of 88 people met the inclusion criteria for our cross sectional study; Which includes those with age more than 18 years, both genders, normal BMI and obese populations, people with and without DM. Those with a history of chronic pancreatitis or previous pancreatitis attacks requiring hospitalization and/or drug-induced pancreatitis (e.g. Amiodarone, cortisone, Valproate, methotrexate) were excluded, as was anyone consuming more than 20 g of alcohol per day. Group 1 included diabetics with normal BMI, Group 2 included diabetics with BMI above 25 kg/m, Group 3 included non-diabetics with normal BMI, and Group 4 included non-diabetics with BMI over 25 kg/m2. BMI was calculated for each participant (BMI=weight/height2) kg/m2, as well as ran a battery of tests, including complete blood counts (CBCs), liver profiles (transaminases, albumin, bilirubin, GGT and alkaline phosphatase), lipid profiles (triglycerides, cholesterol, low and high-density lipoproteins (LDL and HDL)), serum insulin levels, fasting blood glucose (HBA1c). Fasting insulin (mU/ml) and fasting glucose (mmol/l) were used in the calculation of insulin resistance (IR) using the HOMA-IR equation (13).

It was determined whether or not the patient had fatty pancreas by use of abdominal ultrasonography and the 4-point grading method (14) (table 1). To determine AMIT, researchers used abdomen ultrasound; to determine CIMT, they used neck duplex.

Table 1 grading system of fatty pancreases (14).

Level	Status
Level 0	The pancreas echogenicity was similar to the kidney parenchyma
Level 1	Pancreas echogenicity was slightly higher than in the kidney if the operator can see both in the same view in the transverse epigastric scan with slight move to the right, if the pancreas and kidney could not be displayed in the same screen, the radiologist compared the kidney with the liver and then compared the liver with the pancreas
Level 2	Substantial increase in pancreas echogenicity but lower than the retroperitoneal fat echogenicity
Level 3	Pancreas echogenicity was similar to or higher than the retroperitoneal fat.

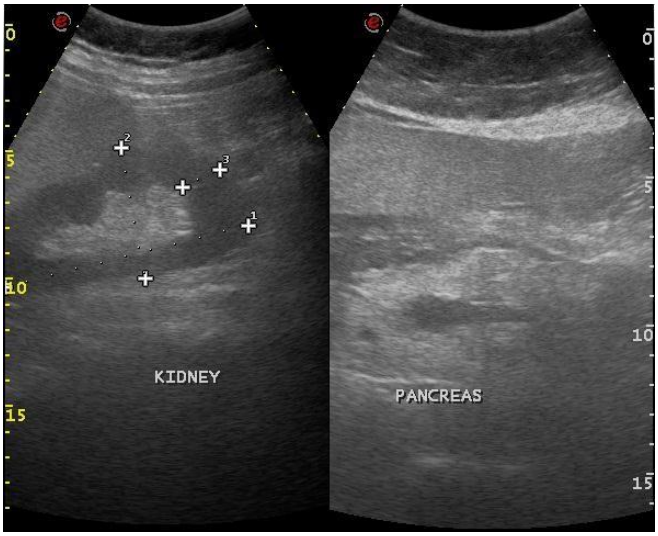

Fig.1:fatty pancreas regarding normal kidney

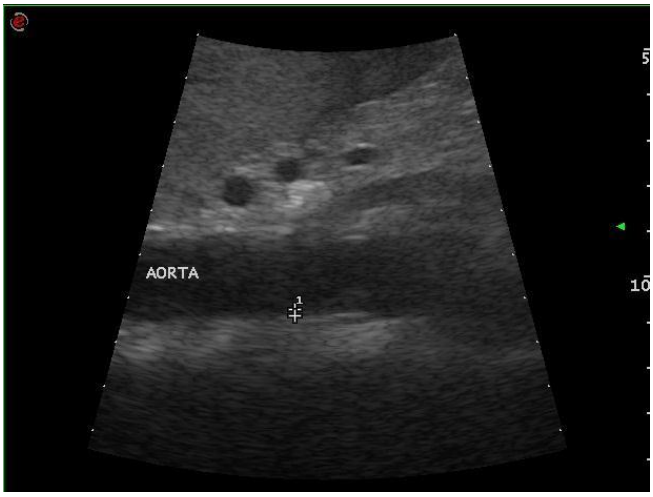

Fig. 2: measurement of aortic intimal thickness

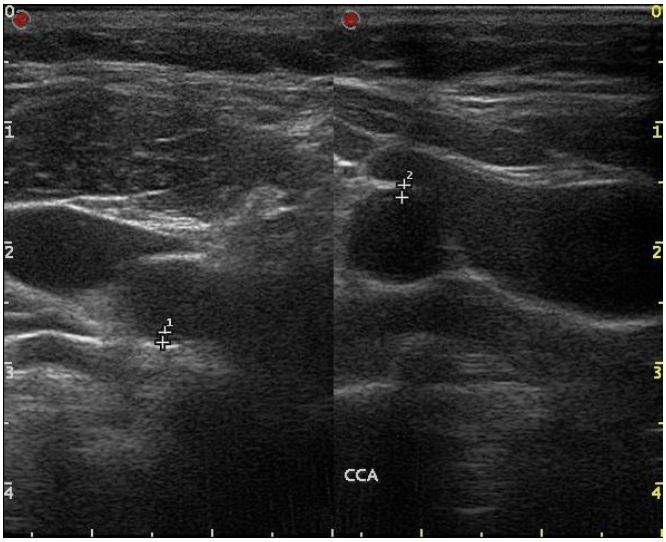

Fig. 3: measurement of carotid intimal thickness

Ethical considerations

The research was approved by the Benha University's local ethics council, all patients were informed verbally of their involvement in the trial, and all data acquired throughout the study period was secure and private. Until the time of the statistical analysis, all papers were kept secure in a locked cabinet.

Statistical analysis

SPSS (IBM Corp., 2017 SPSS, Chicago Illinois, USA) was used to do statistical analysis. For comparison, the Chi2 test was used to evaluate qualitative data reported in frequency and percentages (IBM SPSS Statistics for Windows, Armonk, NY: IBM Corp.). After normality testing, the quantitative data were presented as means and standard deviations, and the means of the groups were compared using one way ANOVA. Any p value less than or equal to 0.05 was deemed statistically significant.

Results

There were 72.7 percent men and 27.3 percent females among our 88 patients, whose mean age 44.08±12.41 and whose mean BMI 29.73±8.15. 21.6 percent of the individuals studied were smokers, and 17.1 percent were hypertensive, according to the results. 84.1 percent of the participants were urban dwellers, whereas 28.4 percent employee (table 1). The greatest WBCs, FBGs, and HbA1c levels were found in diabetic and obese individuals, with p values of 0.004, 0.001, and 0.001 respectively

showing a statistically significant difference between the groups (table 2).

Non-diabetic obese individuals had substantially higher levels of all of mentioned biomarkers (ALT,AST,GGT,ALP,T&D Bilirubin), with each having p values less than 0.05 for each. Cholesterol was significantly greater in obese patients compared to those with a normal BMI, while HDL was significantly lower, followed by diabetes patients with a p value of 0.049. Diabetic and non-diabetic obese groups had different levels of serum insulin, and this difference was statistically significant with p values of 0.008 and 0.01 respectively. Hemoglobin, platelet count, albumin TG and HCV levels did not vary significantly across research groups with a p value >0.05. (table 2).

AIMT was 0.96±0.26 mm in healthy control groups, compared to 1.38±0.20 mm in non-diabetic obese, and 1.24±0.18 mm in normal BMI diabetics and 1.52±0.37 mm in obese diabetes patients, with a p value less than 0.001 showing a statistically significant difference between groups (table 3).

Additionally, CIMT was the lowest among control group 0.58 ±0.18 mm, versus 0.73±0.18 mm in obese non-diabetic, 0.86±0.20 mm in normal BMI diabetics and 1.01 ±0.25 mm among diabetic obese with p value less than 0.001 (table 3).

Obesity was shown to be related with higher grades of fatty pancreases, rather than diabetes, by abdominal ultrasound examination (table 3).

To be considered significant, AIMT in the studied group`s was shown to vary substantially from the control group in terms of pancreatic fat content (p = 0.001). CIMT shows the same findings with a p value of 0.008. Among the other three groups with p values more than 0.05, no such difference was seen (table 3).

Table (1): Demographic characteristics of the studied groups (n=88).

	The studied groups (88)	
	No.	**%**
Gender, n (%)		
Male	64	72.7
Female	24	27.3
	Mean ±SD	**Range**
Age/year	44.08±12.41	18.0-69.0
BMI (kg/m^2)	29.73±8.15	18-43
Special habits		
Smoking	19	21.6
No-smoking	69	78.4
Blood pressure		
Hypertensive	15	17.1
Not Hypertensive	73	82.9
Occupation		
Employee	25	28.4
Manual worker	63	71.6
Residence		
Rural	14	15.9
Urban	74	84.1

Table (2): Comparison of studied groups according to laboratory investigations.

	Non-diabetic (n=44)				**Diabetic (n=44)**				**ANOVA test**	
	Normal BMI		**BMI>25**		**Normal BMI**		**BMI>25**		**Statistical test (F)**	P value
	Mean	**±SD**	**Mean**	**±SD**	**Mean**	**±SD**	**Mean**	**±SD**		
WBCs (c/mm3)	6.2	2.21	6.29	2.14	6.85	2.35	8.51	2.52	4.71	0.004**
Hb (mg/dl)	12.48	1.56	12.48	1.78	12.89	1.64	12.63	1.75	0.29	0.83
PLT (c/mm3)	251.77	63.09	231.0	57.83	213.95	83.61	240.64	73.11	1.15	0.33
FBG (mg/dl)	95.18	7.66	97.95	6.37	195.55	74.0	207.32	78.05	27.83	<0.001**
HbA1c%	4.24	0.18	4.26	0.26	8.15	1.75	8.65	1.90	74.99	<0.001**
ALT (IU/dl)	24.27	10.63	56.18	13.25	39.5	23.18	41.41	19.94	12.25	<0.001**
AST (IU/dl)	20.86	9.67	55.27	14.56	37.77	33.29	59.82	25.41	13.53	<0.001**
GGT(U/l)	29.68	11.75	76.45	13.36	59.41	23.32	72.64	15.02	36.45	<0.001**
ALP (IU/l)	85.55	20.57	161.64	17.81	132.0	42.61	147.64	19.66	32.7	<0.001**
T bilirubin (mg/dl)	0.79	0.21	0.79	0.20	0.87	0.25	0.98	0.19	4.08	0.009**
D bilirubin (mg/dl)	0.42	0.12	0.26	0.19	0.41	0.16	0.44	0.14	6.13	0.001**
Albumin (g/dl)	4.29	0.28	4.11	0.29	3.86	0.38	5.75	8.33	0.91	0.44
Cholesterol (mg/dl)	293.86	125.33	357.41	158.83	201.5	65.18	234.36	99.92	7.53	<0.001**
TG (mg/dl)	100.27	26.66	101.91	30.34	102.32	34.49	133.32	113.	1.43	0.24

HDL(mg/dl)	32.45	8.78	32.23	6.87	37.09	7.46	37.5	0 9.26	2.72	0.049*

Table (3): Comparison of studied groups according to ultrasound findings.

	Non-diabetic (n=44)				**Diabetic (n=44)**				**ANOVA test**	
	Normal BMI		**BMI>25**		**Normal BMI**		**BMI>25**		**Statistical**	**P value**
	Mean	**±SD**	**Mean**	**±SD**	**Mean**	**±SD**	**Mean**	**±SD**	**test (F)**	
AIMT (mm)(0.5 mm)	0.96	0.26	1.38	0.20	1.24	0.18	1.52	0.37	18.08	<0.001**
CIMT (mm)(0.5 mm)	0.58	0.18	0.73	0.18	0.86	0.20	1.01	0.25	17.85	<0.001**
Grades of pancreas										
No	6(27.3)		0(0.0)		0(0.0)		0(0.0)		FET=	<0.001**
I	5(22.7)		0(0.0)		5(22.7)		0(0.0)		30.67	
II	6(27.3)		7(31.8)		7(31.8)		4(18.2)			
II	5(22.7)		15(68.2)		10(45.5)		18(81.8)			

Discussion

The majority of cardiovascular diseases are caused by atherosclerosis, which is a leading cause of death and disability across the globe. (15). The noninvasive assessment of subclinical atherosclerotic disease in persons allows clinicians to more correctly evaluate overall cardiovascular risk (16, 17.)

Tunica intima, tunica medium, tunica externa (tunica adventitia) are the three layers of the arterial wall. The tunica intima and tunica medium layers thicken as a result of atherosclerosis, which causes structural alterations and thickening (18.)

There was a significant difference in CIMT and AIMT with a p value 0.001 between obese and non-obese participants in this research, as well as diabetics and non-diabetics. The mean age of the research groups was 44.08±12.41 years, and the mean BMI was 29.73±8.15. NAFPD has been linked to increased BMI, higher glycated haemoglobin, lipid markers, and systolic blood pressure in several studies (19). The findings of another study show that central obesity and high triglycerides are independent risk factors for developing fatty pancreas (20). According to the NAFPD presence, several research found no substantial difference in BMI (12.)

As a result of the endocrinological activity of adipose tissue, which produces significant amounts of adipokines such as leptin and adiponectin, and cytokines such as TNF, IL-6, MCP-1, and macrophages that produce IL-

1b and MPO, atherosclerosis is likely to occur (1.)

substantially greater CIMT and AIMT than those without these conditions, both with p values 0.001. With a p-value of 0.001, another study found that AIMT was considerably greater in patients with NAFPD than in control groups, and these results may be explained by an excess of chemokine section by adipose tissue (1.)

Another study found that NAFPD was connected with increased age, increased AIMT, and carotid artery plaques in 198 T2DM patients; however, the same research found that NAFPD was not associated with carotid atherosclerosis in the obese T2DM group (21). Non diabetic obese individuals had a greater CIMT and AIMT according to the results of the present research.

A Turkish study reported that presence of NAFPD was significantly associated with increased carotid intima–media thickness ($p < 0.05$), however this correlation was not significant after adjustment for other confounding factors as age and gender (22).

Conclusion

Those with NAFPD had considerably greater levels of CIMT and AIMT than patients with normal pancreas.

It was noticed from our research that patients with obesity and /or diabetes had

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