Relationship between Echocardiographic Epicardial Fat Thickness and Different Body Fat Distribution

Noora Ibrahim Mustafa[1], Abbas Fadhil Abd-Alwahab[2], Abdulameer Abdulbari Abdulhame[3]

[1]Post graduate, [2]Assistant Prof., Department. of Physiology, College of Medicine, Al-Nahrain University, Baghdad, Iraq, [3]Assistant Prof. Department. of Medicine, College of Medicine, Basrah Medical Collage, University of Basrah,, Basrah, Iraq

Abstract

Background : Obesity is a worldwide complicated health problem. It is connected with an amplified cardiovascular mortality and morbidity result from obesity itself on one hand and concomitant with other medical conditions like (diabetes , hypertension, , sleep apnea syndrome, insulin resistance) on other hand. obesity result in multiple functional and structural cardiac changes which may cause heart failure, these changes detected by developed cardiac imaging methods, one of these methods is Echocardiography which is simple, accurate, non-invasive, sensitive diagnostic tool for evaluation of important cardiac changes related to obesity .

Objectives: The study is aimed to determine the consequences of obesity on echocardiographic value for epicardial fat thickness in adult and middle age Iraqi persons .

Patients and Method: The study was a case-control, based on a non- randomized selected samples from both gender from Basrah city, carried out on 150 subjects aged 20-55 years, persons were grouped according to body mass index to: 1- 50 obese (no history of cardiovascular disease) (BMI≥30kg/m2) , 2- 50 obese having ischemic heart disease (BMI≥30kg/m2) , 50 control apparently healthy (BMI 18.5-24.9) Iraqi subjects all persons underwent transthoracic echocardiography to measure the epicardial fat thickness, this value was stated as mean and standard error. This study was done between December 2018 till April 2019 at the Echocardiography Unit in Basrah Teaching Hospital .

Results: There was a significant increase in epicardial fat thickness in addition to some anthropometric indices among obese subjects as compared to control group , but waist / thigh, waist/hip and conicity index looked unchanged significantly.

Conclusion: Obesity is positively interconnected with increase in epicardial fat thickness in addition to some anthropometric indices that support obesity and can predict cardiovascular risks .

Key words: *Epicardial fat thickness, obesity, body fat distribution*

Introduction

It is a medical condition characterized by extra adipose tissue has accumulated to the amount that cause an adverse health effect[(1)]. It have been growing at a rapid rate in both developing world and the Western societies [(2)]. A study over eight years from 2003-2010 done at al-Basrah revealed that obesity occur in 55.1% of the people [45.3 % of men and 54.7% of women] [(3)]. So the worldwide obesity prevalence is anticipated to increase to 21% in women and 18% in men and surpass by 2025 [(4)].

Epicardial fat (EF) : Is the adipose tissue collected between the visceral pericardium and the myocardium, no fascia or any structure separating it from the epicardial vessels and the myocardium. It has a variable distribution, more noticeable in the atrio-ventricular

and inter-ventricular grooves and lateral wall of the right ventricular [5]. Epicardial fat have inflammatory and metabolic mechanisms besides Myocardial fibrosis [6]. some study illustrate a positive association between the quantity of epicardial fat and the occurrence of coronary atherosclerosis and the capability of adipose tissue in hormones and cytokines secretion that control coronary artery atherosclerosis, so the epicardial fat regarded as important factor causing obesity associated cardiovascular disease [7], another one suggest Linear correlation among epicardial fat thickness and onset and severity of coronary artery disease [8].

The aims of study was to find the relationship between echocardiographic changes and different body fat distribution and demonstrate the relationship between the epicardial fat thickness and coronary artery disease.

Subjects and Methods

Case-control study carried out in the Basra teaching hospital (cardiology and echo-cardio graphical unit). Started at (1\12\2018) and finished at (1\6\2019).

150 subject 67 male and 83 female were recruited from cardiovascular unit (they referred from cardiologist clinic) were included in the research, health and Personal data was obtaining from all Consenting participants and all undergone transthoracic echocardiography and anthropometric measurement. Standardized questionnaires were used, Blood pressure (BP) was measured, Anthropometric characteristics, including height and weight were used to calculate BMI (kg/ m²). Abdominal obesity was assessed by waist circumference ,abdominal circumference, neck, mid upper arm, thigh, hip circumference ,and subscapular fold thickness .

Echocardiographic methods: Transthoracic echocardiography (echo Doppler)was performed in supine and left lateral decubitus position and measurements were taken by standard two-dimensional protocols using commercially available medical ultrasound system (Vivid E9). according to the guidelines of the American Society of Echocardiography.

Epicardial fat thickness measurment :

Measurement of echocardiographic epicardial fat thickness by Two-dimensional transthoracic echocardiography. We registered three cycles of the two-dimensional parasternal long-axis view and the parasternal short-axis view at the basal left ventricular level. the EFT was calculated in millimeters (mm) on the free wall of the right ventricle (RV) in the still images obtained at the end of systole on both parasternal long-axis and short-axis views where the beam of the ultrasound perpendicular to the(interventricular septum) at level of mid- chordal and tip of the papillary muscles. The anterior echo-lucent space between the RV outer wall and the linear echo-dense parietal pericardium was considered to be epicardial fat [9] .

An independent scientific committee reviewed and approved the study protocol and data to be delivered to the subjects.

Statistical Analysis

Data was analyzed by dividing the subjects in to three groups according to BMI (BMI= 18.5-24.9 and BMI= >30kg/m2), mean and standard deviations(M, SD) were considered. Independent T test , Fisher exact test and Yates chi square test (using SPSS version 19) were used to compare the study groups. Probability P value of less than 0.05 was considered statistically significant ($\alpha \leq 0.05$) .

Results

Table 1: The neck, mid upper arm, waist, abdominal, hip, thigh circumference Subscapular fold, epicardial fat thickness were significantly differ with greater mean among obese free from ischemic heart disease than control group with P value>0.01 for all variables .other variables in table below insignificantly correlated between two group .

Table 1: Comparison of parameters between all control and all obese free from ischemic heart disease by unpaired t-test.

Parameters	Control N=50 Mean ±SD	No IHD N=50 Mean ±SD	P value
Neck circumference (cm)	36.18+3.35	40.24+4.99	<0.001
Subscapular Fold Thickness	28.34+5.05	41.04+7.28	<0.001
Mid Upper Arm Circumference	31.54+4.33	37.3+4.36	<0.001
Waist circumference (cm)	85.28+9.42	122.5+117.37	0.028
Abdominal circumference (cm)	90.1+9.0	111.76+11.26	<0.001
Hip circumference (cm)	95.22+7.3	110.1+8.5	<0.001
Thigh circumference (cm)	41+6.25	49.94+8.52	<0.001
waist/hip ratio	0.9+0.09	1.12+1.07	0.152
waist/thigh ratio	2.13+0.41	2.52+2.47	0.270
waist/height ratio	0.61+0.57	0.75+0.74	0.283
Conicity index	1.22+0.21	1.52+1.55	0.185
Epicardial fat thickness	0.39+0.12	0.53+0.12	<0.001

Table 2 : lists links among neck circumference and various anthropometric and echocardiographic measures between two group revealed that (neck, mid upper arm, waist, abdominal, hip, thigh circumference, waist/hip Subscapular fold, epicardial fat thickness were statistically differ and significantly higher among obese having ischemic heart disease than control group with P value>0.01 for all and 0.06 for waist/ hip. Other variables in table below insignificantly correlated between two group.

Table 2: Comparison of parameters between control and obese patients having IHD by unpaired t-test.

Parameters	**Control N=50 Mean ±SD**	**IHD N=50 Mean ±SD**	**P value**
Neck circumference (cm)	36.18+3.35	41.98+2.96	<0.001
Subscapular Fold Thickness	28.34+5.05	41.66+8.0	<0.001
Mid Upper Arm Circumference	31.54+4.33	37.7+6.01	<0.001
Waist circumference (cm)	85.28+9.42	103.66+9.72	<0.001
Abdominal circumference (cm)	90.1+9.0	109.66+14.66	<0.001
Hip circumference (cm)	95.22+7.3	107.62+15.85	<0.001

Cont... **Table 2: Comparison of parameters between control and obese patients having IHD by unpaired t-test.**

Thigh circumference (cm)	41+6.25	51.92+8.11	<0.001
waist/hip ratio	0.9+0.09	0.98+0.2	0.006
waist/thigh ratio	2.13+0.41	2.05+0.41	0.316
waist/height ratio	0.61+0.57	0.64+0.07	0.707
Conicity index	1.22+0.21	1.27+0.08	0.132
Epicardial fat thickness	0.39+0.12	0.5+0.12	<0.001

Table 3: In comparison among 100 obese patients by using the unpaired T test half have ischemic heart disease and other half free from ischemic heart disease displayed that neck circumference is greater in obese people having ischemic heart disease than those free from ischemic heart disease . while other variables insignificantly differ between two groups .

Table 3:Comparison of parameters between obese patients free from IHD and obese with IHD by unpaired t-test

Parameters	No IHD N=50 Mean ±SD	IHD N=50 Mean ±SD	P value
Neck circumference (cm)	40.24+4.99	41.98+2.96	0.036
Subscapular Fold Thickness	41.04+7.28	41.66+8.0	0.686
Mid Upper Arm Circumference	37.3+4.36	37.7+6.01	0.704
Waist circumference (cm)	122.5+117.37	103.66+9.72	0.261
Abdominal circumference (cm)	111.76+11.26	109.66+14.66	0.424
Hip circumference (cm)	110.1+8.5	107.62+15.85	0.332
Thigh circumference (cm)	49.94+8.52	51.92+8.11	0.237
waist/hip ratio	1.12+1.07	0.98+0.2	0.393
waist/thigh ratio	2.52+2.47	2.05+0.41	0.183
waist/height ratio	0.75+0.74	0.64+0.07	0.289
Conicity index	1.52+1.55	1.27+0.08	0.263
Epicardial fat thickness	0.53+0.12	0.5+0.12	0.135

Discussion

Obesity is a growing major well-being problem in the developing and developed countries. Old-fashioned obesity indices like (BMI), waist-hip-ratio (WHR), waist circumference (WC) are well recognized measures to detect obese subjects, but, in the current study, the application of subscapular fold thickness, NC, mid upper arm circumference measurement were tested as an added tool for recognizing obese people and to investigate the correlation between the obesity and heart changes that demonstrated by echocardiography. On the other hand, body fat distribution is as important as central fat mass can be recognized as an independent risk factor for cardiovascular disease and metabolic disease as well as overall mortality. In contrast, peripheral fat mass may independently contribute to a lower risk for cardiovascular disease [10].

It was aimed in this study to use neck circumference as an important predictor of some complications of obesity, we found there was significant correlation of neck circumference and BMI and ischemic heart disease as the mean of neck circumference in obese having ischemic heart disease greater than mean of obese free from ischemic heart disease and control groups so the neck circumference regarded as risk factor for heart ischemic changes, that supported by many studies : Simpson conclude there was a significant association between changes in NC and BMI, Ben- Noun and Laor and Onat showed that NC was associated with metabolic syndrome [11,12].

The subscapular skinfold thickness (SST) is a simple measure of truncal obesity (subcutaneous fat), as compared to body mass index (BMI), it might represent a more direct and better measure of body adiposity, that proved by Large epidemiological studies [13,14]. In the present results, show the mean of subscapular skinfold thickness was significantly higher in obese as compared to control , and significantly higher in obese with ischemic heart disease than control group, that mean there was positive correlation between subscapular skinfold thickness and BMI, and it represent risk factor for heart disease similar finding have been reported by Donahue RP and Abbott RD (1987) they observed positive association between sub scapular fold thickness CVD risk factors [15] , and other study show it associated with unfavorable lipid profile , BP, central obesity, high insulin level and increase left ventricular mass [16], So it used as predictive for risk factors of cardiovascular disease (CVD) [17] .

It was also shown that there is a positive relationship between body mass index (BMI) and mid-upper arm circumference. Similar findings have been reported in Spain by [18]. Our findings provide evidence that waist circumference is positively and significantly interrelated to BMI and cardio metabolic risk as proved by other studies high WC increases vulnerability to insulin resistance and dyslipidemia, mostly because of its association with visceral fat [19] , central fat deposition assessed by waist circumference has cardiac risk more than peripheral fat distribution [20] ,abdominal obesity assessed by waist circumference is strongly associated with CHD risk factors than is BMI [21]. The present study illustrate significant association (P value>0.001) between high epicardial fat thickness and BMI that demonstrated by transthoracic echocardiography and that was also realized by Torres et al [22]. Also other study show similar result increase epicardial fat thickness in obese as compared to normal persons ,also verify the strong correlation between epicardial fat thickness and waist circumference, we need more time and larger sample size to investigate such relation[23]. Also, in comparison between obese patients have ischemic heart disease and control subject show that the epicardial fat thickness was thicker in obese than control that mean it regarded as risk factor for cardiac disease as proved by other studies showed that there was significant association between epicedial fat thickness and the severity of coronary artery disease , epicardial fat thickness also correlated to other cardiac situations including myocardial fibrosis , left ventricular dysfunction, coronary spasm and coronary artery calcification [24]. Another study demonstrates that epicardial fat thickness closely associated with the coronary artery disease [25] .

Conclusions

This study suggest that epicardial fat thickness was linearly interconnected with BMI and might be regarded as useful parameter for expecting future ischemic cardiac changes. Many anthropometric parameters like: NC, MUAC, WC and sub scapular fold thickness regarded as beneficial screening tool for obesity, also as predictors

of future cardiac ischemic attacks.

Ethical Clearance: The Research Ethical Committee at scientific research by ethical approval of both environmental and health and higher education and scientific research ministries in Iraq

Conflict of Interest: The authors declare that they have no conflict of interest.

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