

The Correlation of Epicardial Fat Thickness with Ischemic Heart Disease among Patients Consulting Merjan Medical City in Babil

Hassan Salim Aljumaily¹, Abdulhamza Rajooj Hmood²

¹Ass. Prof., College of Medicine, Babylon University/Iraq,

²Ass. Prof., College of Medicine, Karbala University/Iraq

Abstract

Introduction: Epicardial fat thickness (EFT) is regarded as marker of cardiovascular risk.

Aim of Study: To show if there is correlation between EFT with ischemia and its correlation with other variable as age, sex, hypertension, Diabetes, smoking and Body mass index.

Patients and Method: We studied 100 patients who consulting merjan medical city in Babylon province for the period from December 2017 to May 2018. Transthoracic echocardiography was done for all patients; we measure wall motion score and EFT. 50 patients had ischemic heart disease (IHD). EFT measured at free wall of RV at end systole both group from short axis view and long axis view and wall motion score also measured according to this formula.

Results: Mean age was (58.67±13.3), 50% had hypertension, 45% had diabetes .74 patient were male 37% are smoker regarding body mass index, 31.87% are obese, 31.87% over weight 36.2% are normal body mass index. PT with no IHD had normal wall motion score 16/16 While IHD group PT had higher than 16-wall motion score. EFT had significant correlation with high ischemic score, EFT was higher among smoker patients (p value 0.001) and diabetic patients (p value 0.005) and hypertensive patients (p value 0.002). Patients with increasing BMI had higher EFT (p value 0.001).

Conclusions: This study concludes that patients with higher EFT had higher ischemic score, so it is a risk factor of IHD. EFT more than 5.5 in male and 5.7 in female associated with ischemia. Epicardial fat increase with higher BMI and more in smoker, HT and diabetic patients.

Keyword: Epicardial fat thickness, ischemic heart disease, echocardiography.

Introduction

EFT has been designated as a risk factor for CAD⁽¹⁾ and predictor for the presence of cardiovascular insults⁽²⁾. Its site between visceral pericardium and the myocardium. Studies show that epicardial fat immediately surrounds the coronary arteries it postulated that it produce substances that act as an endocrine

organ secreting hormones like bio active chemokines and adipokines⁽³⁾ which predispose to coronary artery disease consequently EFT may have significant role as risk factor in patients presenting with chest pain. EFT can be calculated by TTE, cardiac (CT), and cardiac MRI. Assessment by TTE has come to the front because of many benefits, like availability, less cost; there is no exposure to radiation. EFT illustrated by TTE is the echo-lucent area between the visceral pericardium and myocardium of the right ventricle appear above the right ventricular free wall as a thick line^(4,5). While assessing epicardial fat (EPF), necessary to differentiate it from pericardial adipose tissue, both emerge from different embryonic sites, their local circulation and bimolecular

Corresponding Author:

Hassan Salim Aljumaily

Ass. Prof., College of Medicine, Babylon University/
Iraq

characteristics are different⁽⁶⁾. Anterior to EPF and parietal sheet, there is pericardial tissue (hypoechoic zone)⁷. EPF not interfere with cardiac cycle so it can simply separate. EFT have transparent and spotted appearance on Echo and Pericardial effusion highly hypoechoic⁸. Difference studies about EFT thickness Jacobellis et al⁽⁹⁾ stated that EFT width designed throughout end – systole it is (1-22.6) mm, mean is 6.5 mm in females, 9.5 mm in male⁷. The concept is that EFT play a role in the incident of ischemic heart disease through correlation with other risk factors and by direct paracrine and other endocrine effects. This theory was suspected many years ago illustrating there is no atherosclerosis inside myocardial only¹⁰. Coronary arteries with no EFT detached from it by abridge of myocardial tissue that save from progress of atherosclerosis. Loss adipose tissue in myocardium consider important protection mechanism against atherosclerosis in intramural coronary artery while epicardial coronary arteries have adipose tissue so it more likely to have atherosclerosis. EFT give feature of atherosclerosis by discharge of bioactive molecules and special mechanical factor in coronary arteries⁽¹¹⁾. Because of its intrinsic compressibility epicardial fat suggested to play significant role in the vessel wall expansion called positive remodeling. Coronary injuries, which are bounded by the epicardial fat, have expanded more than injuries bounded by the myocardium⁽¹²⁾.

Method

A cross sectional study 100 patient were studied whom consulting merjan medical city in Babylon province for the period from December 2017 to May 2018. Half of patients had IHD. Medical history of HT, D.M, gender and smoking obtained and their age recorded. Blood pressure was measured by mercurial sphygmomanometer hypertension when SBP ≥ 140 mmHg, DBP ≤ 90 mmHg or need for anti-hypertensive drugs, body mass index was calculated as BW in kilogram divided by height squared⁽¹³⁾. DM according to criteria of American diabetic association as FBG > 126 mg (>7 mmol/dl) or patient with classical symptom of hyperglycemia with random plasma glucose > 200 mg /dl or (>11.1 mol/dl)⁽¹⁴⁾. b Lipid profile not assessed because most patient with ischemic heart disease on lipid lowering age.

Echo Measurement: TTE were performed with GE vivid E9 echo devise instrument according to standard technique with patient in left lateral side to measured EFT on RV free wall from parasternal long and short

axis view we assess the finding three time and we take the mean .this assessment obtained under supervision of two cardiologist. We prefer to measure at end systole because compression of EPF occur during diastole. Also by echocardiography, we assess wall motion abnormal wall motion that can be classified as (2-1).

Description	Motion	Score
Full in ward motion	Normal	1
< 50% full inward motion	Hypokinesia	2
No inward motion	Akinesia	3
Out ward motion	Dyskinesia	4
Out pouch of wall	Aneurysm	5

Exclusion Criteria: Poor echo window, patients with pericardial effusion, Pleural effusion, history of chronic lung or kidney disease or CABG.

Results

Table (1): shows distribution of patients according to their sociodemographic characteristics including (age, gender and smoking habit).

Table (1): Distribution of the study groups according to their demographic data.

Sociodemographic Characteristics		
Age	(58.67 ±13.3)*	(24-86)**
Gender		
Male	74	74%
Female	26	26%
Total	100	100%
Smoking habit		
Smoker	37	37%
Non smoker	63	63%
Total	100	100%

*Mean and standard deviation, **Range

Table (2): The Distribution of patients according to hypertension and Diabetes mellitus history

Chronic diseases	N	(%)
Hypertension		
Present	50	50%
Absent	50	50%
Total	100	100%
Diabetes mellitus		
Present	45	45%
Absent	55	55%
Total	100	100%

Figure 1 shows the relationship between epicardial fat (mm) and BMI (kg/m²) among study patients. There was significant positive linear relation between these two variables. (P = 0.001*).

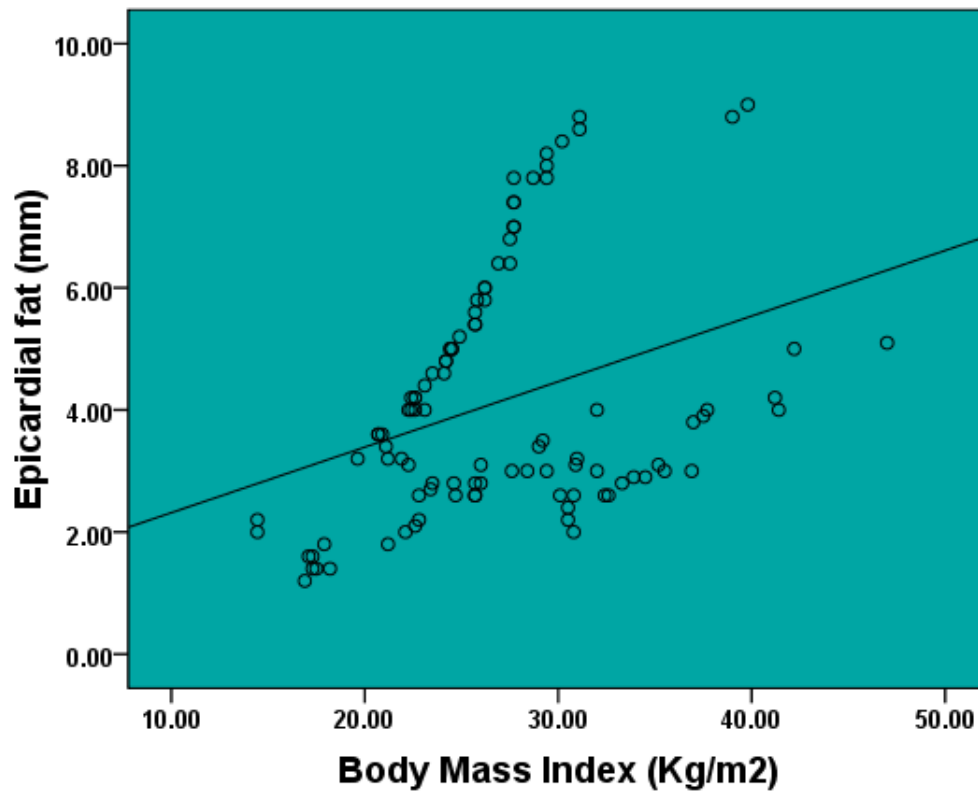


Figure 1: The correlation between and BMI (kg/m²) and epicardial fat (mm) among study patients

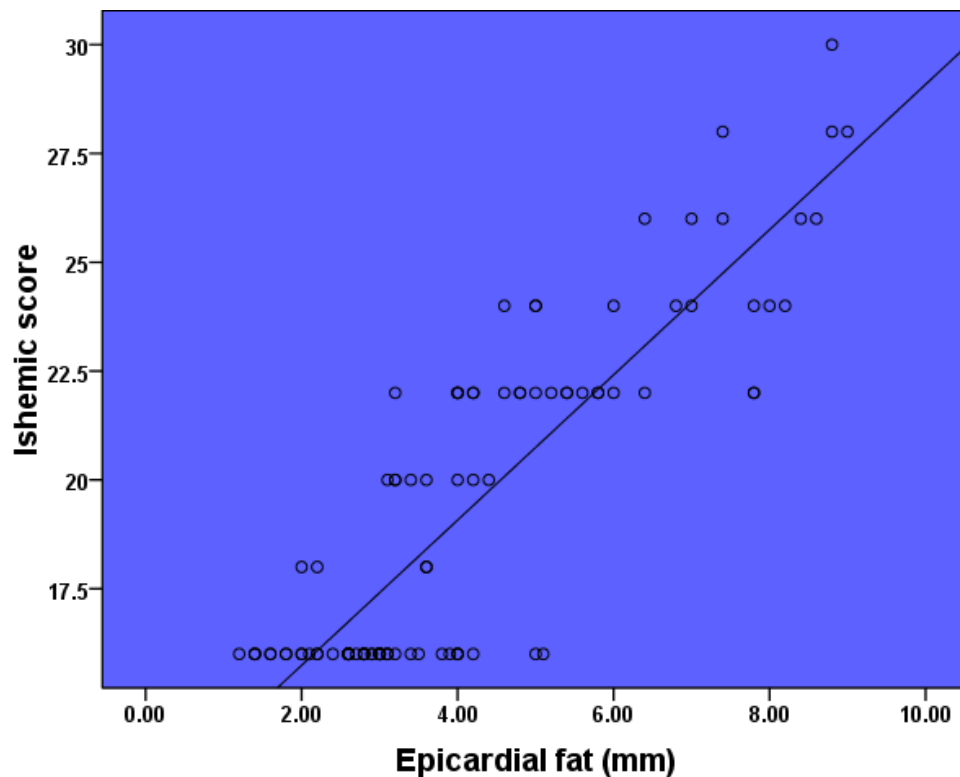


Figure 2 shows the correlation between Ischemic score and epicardial fat (mm) among study patients (n=100). There was significant positive linear relationship

The mean differences of pericardial fat (mm) according to study variables. There is more epicardial fat thickness in hypertensive, diabetic patient and those

with history of smoking with significant correlation while gender show no significant (table 3).

Table 3: The mean differences of epicardial fat (mm) according to study variables.

Variable	Ischemia	N	Mean ± SE	t-test	P-value
Gender	Male	74	4.24 ± 2.07	0.87	0.38
	Female	26	3.85 ± 1.75		
Hypertension	Present	50	4.76 ± 2.02	3.24	0.002*
	Absent	50	3.52 ± 1.78		
Diabetes mellitus	Present	45	4.77 ± 2.14	2.88	0.005*
	Absent	55	3.63 ± 1.71		
Smoking habits	Smoker	37	4.96 ± 2.13	3.29	0.001*
	Non smoker	63	3.66 ± 1.75		

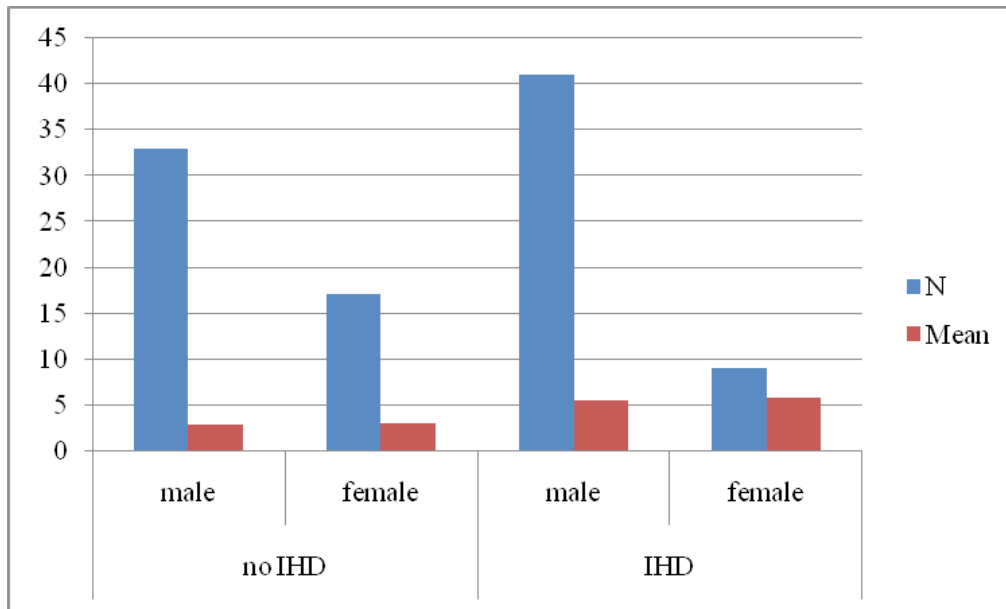


Fig: 3: Epicardial fat of Ischemic and non-ischemic heart disease according to gender: Female patients with ischemia had higher pericardial fat thickness than male patients.

Discussion

In the current study, we discuss correlation of EF with the IHD and EFT & its association with other risk factors for IHD such as HT, DM, BMI, smoking and age. There is a relationship between IHD and EFT, defined as significant independent risk factors among other risk factors. For the role of EFT as CAD risk factors there is a large control cases studies which suggest this correlation, Ahn et al⁽⁴⁾ reveal EFT was more thick in IHD than patients without ischemia and it may give an further marker For IHD many researches shown

that adipose tissue, specifically visceral fat, express many genes attributed to production of adipokine, that had significant evidence for occurrence of CAD in obese patients^{15,16,17}. Epicardial fat located in adjacent to the coronary tree that promote the paracrine effects of epicardial adipokines, as part of the pathogenesis of CAD^{18,19}. There is two important mechanisms for this association: 1- epicardial fat is a part of visceral adiposity and is related to cardiovascular risk factors and metabolic syndrome⁽²⁰⁾. 2- EFT had endocrine features, Ahn et al⁽⁴⁾; stated that EFT active metabolite and had obvious origin of pro and anti-inflammatory cytokine creation,

this unavoidably influence cardiac role and morphology. It yield numerous bioactive particles like adiponectin, resistin, and inflammatory cytokines^(21,22). Transthoracic echocardiography gives a clear assessment of epicardial fat thickness. This can approved by MRI that regarded as the gold standard way to assess visceral adiposity. ECHO as a non-invasive test with little cost used for assessment of epicardial adipose tissue and diagnosis of CAD⁽²³⁾. In our study, EFT more than 5.5 in male and 5.7 in female associated with ischemia this in agreement with lacobellis et al⁽⁹⁾ found that EFT thickness was higher in patient with ischemia. In the current study, important correlation between EF and BMI (p value 0.001), There is strong association between EPF and visceral adipose tissue BMI where demonstrated by Jin-Won et. Al.⁽²⁴⁾ which show Significant association were illustrated between EFT and BMI (p=0.044). Kangwha Cohort Study demonstrated that cardiovascular diseases risk was clearly more in the BMI ≥ 27 kg/m² group in the Korean people⁽²⁵⁾. Higher epicardial fat thickness exclusively associated with the incidence of diabetes, and cardiac contractile dysfunction in diabetes⁽²⁶⁾. In our study, there is higher pericardial fat thickness in diabetic patient than non-diabetic (pvalue 0.005). Increase visceral fat is linked with higher BP presumable over the renin angiotensin scheme. There is association between hypertension and EFT according research²⁷. EAT mount increase in healthy wealthy patients with overstated BP reply to workout stress testing, all this persons with danger of coming hypertension⁽²⁸⁾. EFT in ECHO showed increase in patients with hypertension not treated with non-dipper blood pressure pattern⁽²⁹⁾ in our study there is higher pericardial fat thickness in hypertensive patient than non-hypertensive (p value 0.002). Cigarette smoking is an independent indicator of elevated volume of epicardial fat⁽³⁰⁾. In our study, there is higher pericardial fat thickness in smoker patient than nonsmokers. (Pvalue 0.001). Obesity is important reasons of cardiovascular illness and death. Overweight, obesity reasons 2.8 million deaths worldwide annually, 3% to 9% of possible years of life misplaced, responsible for at least 35% of patients with ischemic heart disease⁽³¹⁾, it related to increase incidence of atherosclerosis and the additional rise in cardiovascular danger⁽³²⁾. Ectopic adiposity defined to include a higher cardiovascular danger than subcutaneous adiposity⁽³³⁾.

Conclusion

Patient with higher EFT had higher ischemic score i.e. EFT is a risk factor of IHD. EFT more than 5.5

in male and 5.7 in female associated with ischemia. Epicardial fat increase with higher BMI and more in HT, DM and in smoker patients.

Ethical Clearance: The Research Ethical Committee at scientific research by ethical approval of both MOH and MOHSER in Iraq

Conflict of Interest: Non

Funding: Self-funding

References

1. Verhagen SN, Visseren FL. Perivascular adipose tissue as a cause of atherosclerosis. *Atherosclerosis*. 2011 Jan; 214(1):3-10
2. Mahabadi AA¹, Massaro JM, Rosito GA, Levy D, Murabito JM, Wolf PA, O'Donnell CJ, Fox CS, Hoffmann U. Association of pericardial fat, intrathoracic fat, and visceral abdominal fat with cardiovascular disease burden: the Framingham Heart Study. *Eur Heart J*. 2009 Apr;30(7):850-6
3. Baker AR¹, Silva NF, Quinn DW, Harte AL, Pagano D, Bonser RS, Kumar S, Mc Ternan PG. Human epicardial adipose tissue expresses a pathogenic profile of adipocytokines in patients with cardiovascular disease. *Cardiovasc Diabetol*. 2006 Jan 13;5:1.
4. Ahn SG, Lim HS, Joe DY, Kang SJ, Choi BJ, Choi SY, et al. Relationship of epicardial adipose tissue by echocardiography to coronary artery disease. *Heart*. 2008;94:e7.
5. Chaowalit N, Somers VK, Pellikka PA, Rihal CS, Lopez-Jimenez F. Subepicardial adipose tissue and the presence and severity of coronary artery disease. *Atherosclerosis*. 2006;186:354-9.
6. Lacobellis G, Willens HJ. Echocardiographic epicardial fat : a review of research and clinical applications *J Am Soc Echocardiogr* 2009;22: 1311-9.
7. Lacobellis G, Willens HJ, Barbaro G, Sharma AM. Threshold values of high-ris echocardiographic epicardial fat thickness obesity (Silver Spring) 2008;16:887-92.
8. Sade LE, Eroglu S, Bosbas H, Ozbicer S, Hayran M, Habera A, Mudderrisoğlu H. Relation between epicardial fat thickness and coronary flow reserve in women with chest pain and angiographically normal coronary arteries, *Atherosclerosis* 2009; 204:580-5.

9. Iacobellis G, Assael F, Ribaudo MC, Zappaterreno A, Alessi G, Dimario U. Epicardial fat from echocardiography: A new method for visceral adipose tissue prediction. *Obes Res* 2003;11:304-310.
10. Robicsek F, Thubrikar MJ. The freedom atherosclerosis of intramyocardial coronary arteries: reduction of mural stress-A key factor. *Eur Cardiothorac Surg* 1994; 8:228-235.
11. Prati F, Arbustini E, Labellarte. Eccentric atherosclerotic plaques with positive remodeling have a pericardial distribution: a permissive role of epicardial fat. *Three-dimensional intravascular ultrasound study of left anterior descending artery lesions. Eur Heart J* 2003; 24:329-36.
12. Ishii T, Asuwa N, Masuda S, Ishikawa Y. The effects of a myocardial bridge on coronary atherosclerosis and ischaemia. *J pathol* 1998; 185:4-9.
13. Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo JL Jr. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: the JNC 7 report. *JAMA* 2003; 289: 2560-72.
14. Report of the Expert Committee on the Diagnosis and Classification of Diabetes Mellitus. *Diabetes Care* 1997; 20: 1183-97.
15. Sam Kaddoura. *Echo made easy* third edition 2016. p74.
16. Mazurek T, Zhang L, Zalewski A, Mannion JD, Diehl JT, Arafat H, Sarov-Blat L, O'Brien S, Keiper EA, Johnson AG, Martin J, Goldstein BJ, Shi Y. Human epicardial adipose tissue is a source of inflammatory mediators. *Circulation*. 2003; 108:2460–2466.
17. Maeda K, Okubo K, Shimomura I, Mizuno K, Matsuzawa Y, Matsubara K. Analysis of an expression profile of genes in the human adipose tissue. *Gene*. 1997; 190:227–235.
18. Chaldakov GN, Stankulov IS, Aloe L. Subepicardial adipose tissue in human coronary atherosclerosis: another neglected phenomenon. *Atherosclerosis*. 2001; 154:237–238.
19. Chaldakov GN, Beltowsky J, Ghenev PI, Fiore M, Panayotov P, Rancic G, Aloe L. Adipoparacrinology–vascular periadventitial adipose tissue (tunica adiposa) as an example. *Cell Biol Int*. 2012; 36:327–330.
20. Alberti KG, Eckel RH, Grundy SM, Zimmet PZ, Cleeman JI, Donato KA, Fruchart JC, James WP, Loria CM, Smith SC Jr. Harmonizing the metabolic syndrome: a joint interim statement of the International Diabetes Federation Task Force on Epidemiology and Prevention; National Heart, Lung, and Blood Institute; American Heart Association; World Heart Federation; International Atherosclerosis Society; and International Association for the Study of Obesity. *Circulation*. 2009; 120:1640–1645.
21. Shibata, R., Ouchi, N. & Murohara, T. Adiponectin and cardiovascular disease. *Circulation Journal* 73, 608–614 (2009).
22. K. Meenakshi, M. Rajendran, S. Srikumar, and Sundar Chidambaram. Epicardial fat thickness: A surrogate marker of coronary artery disease – Assessment by echocardiography. *Indian Heart J*. 2016 May-Jun; 68(3): 336–341.
23. Teresa G Yañez-Rivera, Manuel A Baños-Gonzalez, Jorge L Ble-Castillo, Manuel E Torres-Hernandez, Jorge E Torres-Lopez and Gabriela Borrayo-Sanchez. Relationship between epicardial adipose tissue, coronary artery disease and adiponectin in a Mexican population. *Cardiovasc Ultrasound*. 2014; 12: 35.
24. Jin-Won Jeong, Myung Ho Jeong, Kyeong Ho Yun, SeokKyu Oh, EunMi Park, Yun Kyung Kim, Sang Jae Rhee, Eun Mi Lee, Je Lee, Nam Jin Yoo, Nam-Ho Kim, Jong Chun Park. Echocardiographic Epicardial Fat Thickness and Coronary Artery Disease. *Circulation Journal*; (2007) 71(4): 536-539.
25. Hong JS, Yi SW, Kang HC, Ohrr H: Body mass index and mortality in South Korean men resulting from cardiovascular disease: a Kangwha cohort study. *Ann Epidemiol*. 2007, 17 (8): 622-627.
26. Chun H, Suh E, Byun AR, Park HR, Shim KW. Epicardial fat thickness is associated to type 2 diabetes mellitus in Korean men: a cross-sectional study. *Cardiovasc Diabetol*. 2015; 14:46.
27. Sironi AM, Pingitore A, Ghione S, De Marchi D, Scattini B, Positano V. Early hypertension is associated with reduced regional cardiac function, insulin resistance, epicardial, and visceral fat. *Hypertension* 2008; 51: 282-8.
28. engül C, Özveren O, Duman D, Eroğlu E, Oduncu V, Tanboğa HI. Echocardiographic epicardial

- fat thickness is related to altered blood pressure responses to exercise stress testing. *Blood Press* 2011; 20:303-8.
29. engül C, Çevik C, Özveren O, Duman D, Eroğlu E, Oduncu V. Epicardial fat thickness is associated with non-dipper blood pressure pattern in patients with essential hypertension. *Clin Exp Hypertens* 2012; 34: 165-70.
 30. Monti M, Monti A, Murdolo G, Di Renzi P, Pirro MR, Borgognoni F, Vincentelli GM. Correlation between epicardial fat and cigarette smoking: CT imaging in patients with metabolic syndrome. *Scand Cardiovasc J*. 2014 Oct; 48(5):317-22.
 31. Ng M, Fleming T, Robinson M, et al. Global, regional, and national prevalence of overweight and obesity in children and adults during 1980-2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet*. 2014; 384:766–781.
 32. Hubert HB, Feinleib M, McNamara PM, Castelli WP. Obesity as an independent risk factor for cardiovascular disease: a 26-year follow-up of participants in the Framingham Heart Study. *Circulation*. 1983 May; 67(5):968-77.
 33. Després JP Body fat distribution and risk of cardiovascular disease: an update. *Circulation*. 2012 Sep 4; 126(10):1301-13.