The Correlation between Metabolic Syndrome and Coronary Artery Disease in Egyptian Patients

Mansour M. Mostafa, Abdelaziz R. Hassan, Mohammed Abdel Hady, Yasser E. Mohammed and Hesham M. El Zomor.

Cardiology Department, Faculty of Medicine, Al-Azhar University

Abstract: The most common cause of death due to cardiovascular disease is coronary artery disease (CAD), which is a progressive inflammatory disease with underlying atherosclerosis in its aetiology. Obesity is a growing health proplem in most developed and some developing countries. It is a very important risk factor for cardiovascular disease as well as type 2 diabetes mellitus, hypertension, osteoarthritis, fatty liver, infertility and other problems collectively named metabolic syndrome.The angiographic severity of CAD influences the prognosis. Gensini score is one of the methods that determine the angiographic severity and the extent of CAD. The incidence of metabolic syndrome is an increasing trend in developing countries because of the westernization of diet and lifestyle. To our knowledge, there are no enough literature data on the correlation between metabolic syndrome and coronary disease among egyptian population. The objective of this work was to study the correlation between metabolic syndrome and coronary artery disease in Egyptian patients undergoing coronary angiography for known or suspected coronary artery disease. We studied 100 patients,50 subjects with metabolic syndrome and 50 other without metabolic syndrom, with suspected or known CAD. The results of this study showed that there were statistically significant difference between 2 groups as regard body mass index (BMI), waist circumference, fasting blood sugar, hypertension, HDL, serum TG, Modified Gensini score (MGS). The results also showed that there were significant direct correlation between MGS and BMI, waist circumference,FBS, hypertension, TG, and negative correlation with HDL. The conclusion from our results suggested that total prevalence of MS was found to be 50 % in egyptian patients undergoing coronary angiography and MS is a risk factor for significant coronary stenosism, so the detection, prevention and treatment of the underlying risk factors of metabolic syndrome should become an important approach for reduction of the cardiovasular disease burden in Egyptian population.

[Mansour M. Mostafa, Abdelaziz R. Hassan, Mohammed Abdel Hady, Yasser E. Mohammed and Hesham M. El Zomor**. The Correlation Between Metabolic Syndrome and Coronary Artery Disease in Egyptian Patients.** *N Y Sci J* 2012;5(12):183-189]. (ISSN: 1554-0200). http://www.sciencepub.net/newyork. 31

Keywords: Correlation; Metabolic Syndrome; Coronary Artery; Disease; Patient

1. Introduction:

The most common cause of death due to cardiovascular disease is coronary artery disease (CAD), which is a progressive inflammatory disease, with underlying atherosclerosis in its etiology (Libby *et al.,* 2002). Obesity is a growing health problem in most developed and some developing countries. It is a very important risk factor for cardiovascular disease as well as type 2 diabetes mellitus, hypertension, osteoarthritis, fatty liver, infertility and other problems collectively named metabolic syndrome. According to the international Diabetes federation (IDF) definition, a participant was defined as having the metabolic syndrome if he or she had central obesity plus 2 or more of the following criteria, raised TG levels of 1.7mmol/L or higher, reduced HDL-C levels of less than 1.03 mmol/L in men, less than 1.29mmol/L in women, raised systolic or diastolic blood pressure of 130/85 mmhg or higher or previously diagnosed hypertension and raised fasting plasma glucose level of 5.6 mmol/l or higher or previously diagnosed type 2 diabetes mellitus.

To define central obesity, we used the European criteria 94 cm waist circumference threshold for central obesity in men and 80 cm or more in women (Alberti *et al.,* 2005).

Different methods exist for clinical evaluation of obesity, the body mass index (BMI), waist circumference (WC), waist /hip ratio, waist height ratio and skin fold thickness are clinical tools enabling health teams to evaluate obesity and fat distribution.

As central fat distribution is considered more atherrogenic than peripheral obesity, much attention has been focused on methods that can evaluate central obesity (M. Siavash et al., 2008).

2. Patients and Methods

One hundred patients, 65 males and 35 females, with suspected or known Coronary artery disease, referred to our cath lab in Cardiology department at Mahalla Cardiac Centre for diagnostic coronary angiography between December 2011 and May 2012.

The study subjects were divided into two main groups, group I, fifty subjects with metabolic syndrome and group II, fifty patients without metabolic syndrome. Patients were selected according to the following inclusion criteria,

Egyptian patients planned for coronary angiography for known or suspected coronary artery disease. All patient underwent informed consent, history taking with special emphasis on history of hypertension, (Systemic hypertension was defined as a systolic blood pressure greater than or equal to 140 mmHg and/or a diastolic pressure greater than or equal to 90 mmHg and/or the use of antihypertensive medication), history of Diabetes mellitus (Defined by the use of hypoglycemic medications), history of ischemic heart disease (SA, UA, Ml),history of dyslipidaemia (Hyperlipidemia was defined by treatment with a lipid-lowering agent.)

All patients were assessed clinically, including the evaluation of cardiovascular risk factors, and the measurement of height, weight, body mass index (BMI) and waist circumference. The BMI was calculated from the body weight in kilograms divided by the square of the height in meters. Measurement of waist Circumference by using non-stretchable tape, making sure its level around the body. Parallel to the floor, and tighten it without depressing the skin.

Measure the waist at its narrowest point width wise, usually just above hip bone & below thoracic cage.

Electrocardiographic (ECG) evaluation:

12 leads electrocardiography were done to all patients.

Laboratory evaluation:

Blood samples was collected by venepuncture after an overnight fast for Triglycerides, High density Lipoproteins, Fasting blood sugar levels were obtained before angiography.

Coronary angiography:

Diagnostic coronary artery catheterizations were done to all patients to assess the severity and the extent of CAD and assesse modified Gensini score.

Modified Gensini score method defines narrowing of the lumen of the coronary arteries as 5 scores for left main coronary lesion, 2.5 scores for proximal left anterior descending (LAD) artery and the left circumflex artery, 1.5 scores for the mid-LAD artery lesion, 1 score for the first diagonal branch (D1) and the obtuse marginal branches and right Coronary artery, 0.5 score for the second diagonal (D2) and the LCX posterolateral branch (Gensini, 1983).

Statistical Analysis:

Data were collected and submitted to statistical analysis. The following statistical tests and parameters were used:

mean ± standard deviation (SD), the student t-test, categorical variable were compared by mean of chi-square.

3. Results73

We studied one hundred patients,65 males and 35 females, with suspected or known coronary artery disease, referred to our cath lab in Cardiology department, Mahalla Cardiac Centre for diagnostic coronary angiography between December 2011 and May 2012.

The study subjects were divided into two main groups:

Group I: 50 subjects with metabolic syndrome.

Group II: 50 patients without metabolic syndrome.

Demographic characteristics and risk factors for CAD:

Group I, include fifty patients with mean age ± SD was (54.76±7.9 years), as regard sex, 34 patients (68 %) were males and 16 patients (32%) were females, Mean BMI ± SD was (34.296 ± 6.106 kg⁄m²), mean waist circumference ± SD was (110.68 ± 13.373 cm), 22 patients (44%) were diabetics, 28 patients (56%) were non diabetics, 39 patients (78 %) were hypertensive, 11 patients (22 %) were non hypertensives while group II Mean age ± SD was (59.01±6.5 years)

Group II, include fifty patients with mean age ± SD was (59.0± 6.5 years) as regard sex: 31 patients (62%) were males and 19 patients (38%) were females. Mean BMI ± SD was (29.278 ± 2.745 kg⁄m²). Mean waist circumference ± SD was (81.340± 5.061 cm). Eight patients (16 %) were diabetics, 42 patients (84 %) were non diabetics, and 16 patients (32 %) were hypertensive, 34 patients (68 %) were non hypertensive.

There was no statistically significant difference between the two groups as regards Age (*P*-value 0.2966).

Table (1): Comparison between two groups as regard age.

Group	Age	Unpaired T-test	
	Mean± SD	t-value	*P*-value
Group I	54.760±7.935	1.049	0.2966
Group II	56.240±6.043		(NS)

There was statistically extremely significant difference between the two groups as regard BMI (Kg/m^2) (*P*value<0.0001).

Table (2) comparison between two groups as regard BMI.

Group	BMI	Unpaired T-test	
	Mean± SD	t-value	*P*-value
Group I	34.296±6.106	5.301	<0.0001
Group II	29.278±2.745		(Extremely Significant)

There was statistically extremely significant difference between the two groups as regard Waist circumference (*P* value < 0.0001).

Table (3) comparison between two groups as regard waist circumference .

Group	Waist circumference	Unpaired T-test	
	Mean± SD	t-value	*P*-value
Group I	110.68±13.373	14.509	<0.0001
Group II	81.340±5.061		(Extremely Significant)

There was no statistically significant difference between the two groups as regard sex (*P*-value > 0.05).

Table (4) comparison between two groups as regard sex.

	Group I		Group II		Total		Chi-square test	Fisher's test
	N	%	N	%	N	%	*P*-value	*P* -value
Males	34	34%	31	31%	65	65%	0.6750	0.6753
Females	16	16%	19	19%	35	35%	(NS.)	(NS)
Total	50	50%	50	50%	100	100%		

There was statistically significant difference between the two groups as regard fasting blood sugar (***P*** -value = 0.0100).

Table (5) comparison between two groups as regard fasting blood sugar.

Group	FBS	Unpaired T-test	
	Mean± SD	t-value	*P*-value
Group I	141.76±89.668	2.626	<0.0100
Group II	101.74±59.785		(Significant)

There was statistically extremely significant difference between the two groups as regard Hypertension (*P*-value < 0.0001).

Table (6) comparison between two groups as regard hypertension.

	Group I		Group II		Total		Chi-square test	Fisher's test
	N	%	N	%	N	%	*P* -value	*P* -value
Hypertensive	39	39%	16	16%	55	55%	< 0.0001	< 0.0001
Non-Hypertensive	11	11%	34	34%	45	45%	(Extremely)	Extremely Significant
Total	50	50%	50	50%	100	100%	Significant	

There was statistically extremely significant difference between the two groups as regard HDL (***P*** -value < 0.0001).

Table (7) comparison between two groups as regard HDL.

Group	HDL	Unpaired T-test	
	Mean± SD	t-value	*P* -value
Group I	34.980±5.415	13.588	<0.0001
Group II	50.240±5.808		(Extremely Significant)

There was statistically extremely significant difference between the two groups as regard serum TG levels (*P*-value < 0.0001).

Table (8):Comparison between two groups as regard TG.

Group	TG	Unpaired T-test	
	Mean± SD	t-value	*P*-value
Group I	127.24±56.169	1.916	<0.0001
Group II	111.08±20.029		(Extremely Significant)

There was statistically extremely significant difference between the two groups as regard Modified Gensini Score (*P*-value < 0.0001).

Table (9):Comparison between two groups as regard modified gensini score.

Group	Modified Gensini Score			Unpaired T-test	
	Mean	±	SD	t-value	*P*-value
Group I	4.580	±	3.246	8.287	<0.0001
Group II	0.5600	±	1.110		(Extremely Significant)

Correlation between Modified Gensini Score and certain parameters (Including age, HTN, FBS, BMI, waist circumference, HDL and TG).

There was no significant correlation between age and MGS with *P* value = 0.2695. There was a significant direct correlation between BMI (kg/m^2) and MGS with *P* value = 0.0400.There was a very significant direct correlation between FBS and MGS with *P* value =0.0020.

There was a significant direct correlation between WC and MGS with *P* value <0.0001. There was a very significant direct correlation between FBS & Modified Gensini Score with *P* value =0.0020.

There was a very significant direct correlation between HTN and Modified Gensini Score with *P* value =0.0021.There was an extremely significant negative correlation between HDL& Modified Gensini Score with *P* value < 0.0001. There was very significant correlation between serum TG levels & Modified Gensini Score with *P* value = 0.0035.

4.Discusion

Metabolic syndrome is a condition which is considered to promote atherosclerosis, and increases the risk of cardiovascular events (Scott *et al.,* 2003).It is characterized by central obesity (waist circumference in males > 94 cm and in females > 80 cm), insulin resistance (Fasting blood glucose >100mg/dL), hypertension (BP > 130/85) and atherogenic dyslipideamia (TG > 150 mg/dL and or HDL<40 mg/dL in males and <50mg/dL in females) (International Diabetes Federation, 2005). Each abnormality promotes atherosclerosis independently, but when clustered together, these metabolic disorders are increasingly atherogenic and enhance the risk of cardiovascular morbidity and mortality (Ford *et al.,* 2004). Currently, MS is a term used to define a patient who presents with three or more of the five carefully defined risk factors (Grundy *et al.,* 2004).

Coronary artery disease has been accepted as a major source of Cardiovascular morbidity and mortality in adults (Braunwald *et al.,* 2009). There have been numerous trials in order to modify risk profiles for this group of patients. Our study aimed to search for the correlation between MS and coronary artery disease.

The aim of this study was to study the correlation between metabolic syndrome and coronary artery disease in Egyptian patients undergoing coronary angiography for known or suspected coronary artery disease. Our study consists of two groups of patients (Group I & Group II) with suspected or known CAD who will undergo coronary angiography, group I includes patients who fulfilled the diagnosis of metabolic syndrome due to International Diabetes Foundation (IDF) definition, group II includes patients who don't have metabolic syndrome.

In our study, and according to IDF classification, we found that, the prevalence of MS was 50%. In the US, the use of the IDF definition of the metabolic syndrome leads to a higher prevalence estimate of the metabolic syndrome than the estimate based on the NCEP definition (Earl, 2005).

In our study there was no statistically significant difference between the two groups as regards Age (*P*-value 0.2966). This result agrees with the study provided by Pil-Ki Min, *et al.,* 2008 where there was no statistically significant difference between the two groups as regards Age (*P*-value 0.710). This result disagrees with the study provided by Rejet J., et al 2009 where the age was statistically significant, this may be due to the large difference between the age of the two study population, Mean age ±SD in our study in the group with metabolic syndrome (54.760±7.935) and in the group without metabolic

syndrome (56.240± 6.043), while Mean age ±SD in the study provided by Rejet J., et al 2009 in the group with metabolic syndrome is (62.6 ± 9.3) and in the group without metabolic syndrome is (59.7 ± 10.2).

In our study, BMI was higher in subjects with metabolic syndrome and the difference between the two groups was extremely significant (*P* value < 0.0001). This result agrees with the study provided by Pil-Ki Min, *et al.,* 2008, where there was statistically significant difference between the two groups as regards BMI (*P*-value < 0.000). This result also agrees with the study provided by Rejet J, et al 2009 in that BMI was higher in subjects with metabolic syndrome, but disagrees with it in that the difference was not statistically significant (*P*-value =0.085). This may be due to the high prevalence of abdominal obesity in Egyptians (Ibrahim MM, et al 2001) and (M. Mohsen Ibrahim, 2009).

In the present study, we demonstrated the significant association between metabolic syndrome diagnosed by International Diabetes Federation definition and coronary artery disease in an Egyptian population. The prevalence of metabolic syndrome clearly varies depending on the definition applied, the ethnicity, and the age of the study population.

The present study showed that the prevalence of the metabolic syndrome was 50% (53.8% in men vs. 45.7% in women) in an Egyptian population with suspected CAD using the IDF definition. This is approximately similar to the total prevalence of metabolic syndrome in the study provided by Rejet J., et al 2009 which was 54.2 %, and the study provided by Marianne Zeller, et al 2005 where 290 patients (46%) among the 633 patients,included in the study, fulfilled the criteria for metabolic syndrome .

With regard to gender, the prevalence of metabolic syndrome was slightly more in men than in women (53.8% vs. 45.7%). This result agrees with the study provided by Kasai T, et al 2008 where is the total prevalence of metabolic syndrome was 46.6% of males and 21.3% of females using the International Diabetes Federation (IDF) criteria, also Metabolic syndrome was slightly more prevalent in men than in women in Americans (The DECODA Study Group, Diabetes Res Clin Pract, 2007), Europeans (The DECODE Study Group, Diabetologia, 2006),South Australians, and Japanese (Ford ES. 2005), (Adams RJ et al, 2005). But this result disagrees with the study provided by Rejet J. et al 2009 where the prevalence of metabolic syndrome was significantly greater in women than in men (65.9% vs. 45.5%), a similar rate (59.5% in women; 53% in men) has been described in recent studies in young Asian Indians with MI (Ranjith N., et al 2008) and in Pakistan in suspected CAD patients (Wierzbicki AS., et al 2008) . This may be due to the small number of cases included in our study and the difference between ethnicity, and the age of the study population involved in these studies.

There was extremely significant difference between the two groups as regard Waist circumference (*P*-value < 0.0001). This is in agreement with study provided by Marianne Zeller *et al* .,2005.

There was significant difference between the two groups as regard fasting blood sugar (*P*-value = 0.0100). This is in agreement with study provided by (Pil-Ki Min, et al 2008),(Marianne Zeller, et al 2005) and (Rejet J.,et al 2009) . There was extremely significant difference between the two groups as regard Hypertension (*P*-value < 0.0001). This is in agreement with study provided by (Pil-Ki Min, et al 2008), (Marianne Zeller, et al 2005) and (Rejet J., et al 2009) .

There was extremely significant difference between the two groups as regard High Density Lipoprotein (HDL) (*P*-value < 0.0001). This is in agreement with study provided by (Pil-Ki Min, et al 2008),(Marianne Zeller, et al 2005) and (Rejet J., et al 2009) .

There was extremely significant difference between the two groups as regard Triglycerides (TG) (*P*-value < 0.0001). This is in agreement with study provided by (Pil-Ki Min, et al 2008), (Marianne Zeller, et al 2005) and (Rejet J., et al 2009) .

Many studies on the association of the metabolic syndrome and risk of CVD have been published in recent years. Given the modifiable nature of the individual components and the increasing prevalence of the metabolic syndrome, research on the metabolic syndrome and ways to reduce the risk of CVD are mandatory for developing better prevention strategies.

There are only a few prospective studies that have reported the relationship between CVD risk factors and metabolic syndrome with IDF criteria, probably because it is the most recent published definition.

Our data showed that metabolic syndrome based on IDF criteria was a risk factor for the development of significant coronary artery disease.

In the present study, we identified that coronary artery disease to be highly prevalent in the metabolic syndrome group compared to the group without metabolic syndrome (*P*-value < 0.0001). This was in agreement with the study provided by (Rejet J., et al 2009), also in agreement with our data, Choi et al. reported that the OR for CAD was 2.8 (95% CI, 1.6–5.0) for participants with metabolic syndrome defined by the IDF definition in a Korean population, similar results by Pakistani cohort, concluded that the

presence of IDF metabolic syndrome was associated with CAD .

In the present study, there was no significant correlation between coronary artery disease scores and the patient's age. This is in disagreement with study provided by Rejet J., et al 2009 . This may be due to the small number of cases included in our study and the difference between ethnicity, and the age of the study Population involved in these studies.

There was a significant positive correlation between BMI (kg/m^2) & MGS with *P* value = 0.0400. This in agreement with the study provided by M. Siavash, et al 2008.

We identified a significant correlation between coronary artery disease score (Modified Gensini Score) and the five metabolic syndrome scores (Central obesity "Waist circumference" *P* value < 0.0001, HTN *P* valuse is 0.0021, DM P value is 0.0020, Hyertriglyceridemia *P* value is 0.0035, and Low HDL *P* value < 0.0001) . This in agreement with the study provided by M. Siavash, et al 2008 & Rejet J., et al 2009.

CONCLUSION: The total prevalence of MS was found to be 50% in Egyptian patients undergoing coronary angiography for proved or suspected coronary artery disease.

This study suggests that metabolic syndrome is a risk factor for significant coronary stenosis, so the detection, prevention, and treatment of the underlying risk factors of metabolic syndrome such as DM, Hypertension, low HDL, hypertriglyceridemia or abdominal obesity should become an important approach for reduction of the cardiovascular disease burden in our study population.

REFERANCES

Adams RJ, Appleton S, Wilson DH, Taylor AW, Dal Grande E, Chittleborough C, GillT, Ruffin R. : Population comparison of two clinical approaches to the metabolic syndrome: implications of the new International Diabetes Federation consensus definition. Diabetes Care. 2005 Nov; 28(11):2777-9.

Braunwald E, Antman EM, Beasley JW *et al.,* American College of Cardiology; American Heart Association. Committee on the Management of Patients with Unstable Angina. ACC/ AHA 2002 guideline update for the management of paıents with unstable angina and non-ST-segment elevation myocardial infarction -summary article: a report of the American College of Cardiology/American Heart Association task force on practice guidelines (Committee on the Management of Paıents With Unstable Angina). J Am Coll Cardiol, 40:1366-1374; 2009.

DECODE Study Group :Does diagnosis of the metabolic syndrome detect further men at high risk of cardiovascular death beyond those identified by a conventional cardiovascular risk score? The DECODE Study. Eur J Cardiovasc Prev Rehabil. 2007 Apr; 14(2):192-9.

Earl S, Ford MD, MPH: IDF classification of metabolic syndrome. Diabetes Care, vol. 28.No(11274); NOV 2005.

Ford ES,A lmgren P,Tuomi T, *et al.*: The metabolic syndrome and mortality from cardiovascular disease and all-causes; findings from the National Healtii and Nutrition Examination Survey II Mortality Study. Atherosclerosis, 173:309-314; 2004.

Gensini GG. A more meaninful scoring system for determining the severity of coronary artery disease. Am J Cardiol. 1983; 51:606.

Grundy SM, Brewer HB Jr, Cleeman Jl *et al.*: American Heart Association; National Heart, Lung, and Blood Institute, Definition of metabolic syndrome: Report of the National Heart, Lung, and Blood Institute/American Heart Association conference on scientific issues related to definition. Circulation, 109:433-438; 2004.

Libby P, Ridker PM, Maseri A. Inflammation and atherosclerosis. Circulation, 2002; 105:1135-43.

M. Mohsen Ibrahim : Subcutaneous and visceral adipose tissue: structural and functional differences, Journal compilation © 2009 International Association for the Study of Obesity.

Marianne Zeller, PhD; Philippe Gabriel Steg, MD, PhD; Jack Ravisy, MD; Yves Laurent, MD; Luc Janin-Manificat, MD; Isabelle L'Huillier, MD; Jean-Claude Beer,MD; Alexandra Oudot, PhD; Gilles Rioufol, MD; Hamid Makki, MD; Michel Farnier, MD; Luc Rochette, PhD; Bruno Vergès, MD, PhD; Yves Cottin, MD, PhD; Observatoire des Infarctus de Côte-d'Or Survey Working Group Arch Intern Med. 2005;165(10):1192-1198. doi:10.1001/archinte.165.10.1192.

Prevalence and Impact of Metabolic Syndrome on Hospital Outcomes in Acute Myocardial Infarction Maseri A, Fuster V (2003). "Is there a vulnerable plaque?".Circulation, 107 (16): 206871. doi:10.1161/01.CIR.0000070585.48035.D1.PM ID 12719286.

Pil-Ki Min, Hee-sun Mun, Young-Won Yoon, Bum-Kee Hong, Se-Joong Rim, Hyuck-Moon Kwon, Hyun Seung Kim, Jeong –Ah Ahn : Effect of Increasing MetabolicSyndrome Score on Plasma Adiponectin Levels and Coronary

Artery Disease Angiographic. Severity. European Society of Cardiology Meeting, 2008.
Ranjith N, Pegoraro RJ, Naidoo DP, Shanmugam R, Rom L.: Genetic variants associated with insulin resistance and metabolic syndrome in young Asian Indians with myocardial infarction. Metab Syndr Relat Disord. 2008 Sep; 6(3):209-14.
Rejet NB, Nabli N, Abdelaziz AB, Boughzala E, Bousslama A. Metabolic syndrome is a risk factor for coronary artery disease in a Tunisian population. Metab Syndr Relat Disord. 2009 Nov 9…..
Scott M. Grundy, MD, PhD; H. Bryan Brewer Jr, MD; James I. Cleeman, MD; Sidney C. Smith Jr, MD; Claude Lenfant, MD; Definition of Metabolic Syndrome,Report of the National Heart, Lung, and Blood Institute/American Heart Association Conference on Scientific Issues Related to Definition.
Wierzbicki AS, Nishtar S, Lumb PJ, Lambert-Hammill M, Crook MA, Marber MS, Gill J. : Insulin resistance phenotypes and coronary artery disease in a native Pakistani cohort.Int J Clin Pract. 2008 May; 62(5):701-7. Epub 2008 Mar 12.

5/12/2012