Journal of Kerbala University , Vol. 6 No.2 Scientific. 2008

Prevalence of Metabolic Syndrome in patients with acute myocardial infarction In Najaf City

Assistant Professor
Dr.Sadiq Jabbar Al- Mohanna
MB.ChB,DM,CABM

Assistant Professor
Dr.MohammadA.Abdul- Hussain
MB.ChB,DM,CABM

Dr.Abbas Hamza Najim
M B.Ch B

Abstract :

Background:
Metabolic syndrome patients are at an increased risk for developing cardiovascular morbidity and mortality .
Objectives:
This study was designed to determine the prevalence of metabolic syndrome in patients with acute myocardial infarction.
Patients and methods:
Forty eight patients with acute myocardial infarction diagnosed by ST segment elevation and ischemic chest pain admitted to the coronary care unit at Al-Sader teaching hospital in Najaf, were evaluated and screened for criteria of metabolic syndrome.
Results:
The prevalence of metabolic syndrome in patients with acute MI found to be 43.8 %.
Metabolic syndrome was more in females than males.
Conclusion:
These results suggest ,that there was a strong association between metabolic syndrome and myocardial infarction (MI) and it was more in female patients.

Introduction :

Coronary heart disease (CHD) is the most common form of heart disease and the single most important cause of premature death in Europe and South America. In UK 1 in 3 men and 1 in 4 woman die from (CHD), an estimated 330,000 people have a myocardial infarction each year and approximately 1.3 million people have angina [(1)].

In the latter half of 20th century risk factors for cardiovascular disease were identified and redefined to increasingly lower and tighter levels. Some of these risk factors such as abdominal obesity, dyslipidemia, hypertension and hyperglycemia, were observed to occur more frequently in patients with impaired glucose tolerance and type 2 diabetes. In 1988, Reaven named this cluster of metabolic risk factors" syndrome X" [(2)].

The metabolic syndrome represents a specific clustering of cardiovascular risk factors in the same individual (abdominal obesity, atherogenic dyslipidemia, elevated blood pressure, insulin resistance, prothrombotic state & proinflammatory state).Almost 50 million American adults (about one in four) have the metabolic syndrome, which puts them at increased risk for development of diabetes mellitus &cardiovascular disease.[(3)]

People with metabolic syndrome are twice as likely to die from, three times as likely to develop, myocardial infarction or stroke compared to people without metabolic syndrome [(4)].They also have a fivefold greater risk of developing type 2 diabetes (if not already present) [(5)].

The third adult treatment panel of the national cholesterol education program suggested that the diagnosis of the metabolic syndrome, which is a frequent cause of coronary artery disease, by the presence of three of five quantitatively defined markers which interact synergistically causing or

accelerating the progression of atherosclerosis and coronary artery disease at any level LDL cholesterol.

Patients Identification

Clinical identification of the metabolic syndrome (MS) requires certain criteria. When three or more of the following risk factors are present, metabolic syndrome (MS) identification will be established. (6)

Risk factors that constitute MS and the corresponding level according to the NCEP (National Cholesterol Education Program) Adult Treatment Panel III are:

1.Central (abdominal) obesity (waist circumference) for men >102 cm & women >88cm.
2.Serum triglyceride 150 mg/dl(1.7mmol/L) or more.
3.Serum high density lipoprotein is less than 40 mg/dl(1mmol/L) for men & less than 50 mg/dl (1.3mmol/L) for women.
4.Blood pressure ≥130/≥85 mmHg.
5.Fasting plasma glucose ≥110 mg/dl (6.1 mmole/L).

The effects of these risk factors are multiplicative rather than additive, people with combination of risk factors are at greatest risk and assessment should therefore be based on a holistic approach that takes account of all identifiable risk factors. (7)

Components of metabolic syndrome

The following are factors that constitute metabolic syndrome according to NCEP ATP III :-

1. Central obesity:

Obesity (BMI>30 Kg/m^2) in adults is an independent risk factor for coronary vascular disease (CVD). Obesity affects the heart through its influence on risk factors such as dyslipidemia, hypertension, glucose tolerance, inflammatory markers, obstructive sleep apnea or hypoventilation, and the prothrombotic state (8).

Morbidly obese individual (BMI>40 Kg/m^2) has as much as twelve fold increase in mortality. Mortality rates rise as obesity increases, particularly when obesity is associated with increased intra abdominal fat.

Abdominal obesity in particular has been documented as risk factor for CVD throughout the world. Abdominal fat distribution is part of the MS, which also include insulin resistance, dyslipidemia, and hypertension (9).

Insulin resistance is more strongly linked to intra abdominal fat than to fat in other depots. The molecular link between obesity and insulin resistance in tissues such as fat, muscle, and liver has been sought for many years with the major factors under investigation being.

1-Insulin itself, by inducing receptor down regulation.
2-Free fatty acids, known to be increased and capable of impairing insulin action.
3-Intracellular lipid accumulation.
4-Various circulating peptides produced by adipocyte, including the cytokines TNF-alpha and interleukin 6 which are capable of modifying insulin action.

Obesity is also associated with hypertension and measurement of BP in obese requires use of a larger cuff size to avoid artifactual increases. Obesity induced hypertension is associated with increased peripheral resistance &cardiac output, increased sympathetic nervous system tone, increased salt sensitivity &insulin mediated salt retention; it is often responsive to modest weight loss (10).

2-Triglyceride level

In many prospective studies triglyceride (TG) level was predictive of (CAD) in a univariate & multivariate analysis controlling for total cholesterol or low density lipoprotein cholesterol levels (11). Although in some analysis this association did not persist after adjustment for HDL cholesterol. Nevertheless, direct evidence for the clinical benefit of elevating HDL cholesterol or reducing blood triglyceride (TG)levels is limited because the efficacy of lipid modifying drugs that lower (TG)levels and raise HDL cholesterol level had not been directly assessed in large clinical trials in CAD patients (12).

An analysis of the joint effect of baseline TG and lipoprotein cholesterols, conducted in the framework of the primary prevention Helsinki heart study, demonstrated a strong interdependence of HDL cholesterol &TG as predictors of CAD risk and a beneficial effect of treatment with fibrates [13].

The Bezafibrate infarction prevention study was designed &initiated in 1990.The primary question of the trial was whether benzofibrate, which raise HDL &reduced triglycerides, would reduce coronary artery disease mortality& non fatal MI in patients with established CAD. They found that, the benzofibrate was effective in elevating HDL &lower TG& have prominent role in the management of dyslipidemia &CAD when targeted to the subgroup of patients with high triglyceride [14].

3-HDL level

Large prospective epidemiological studies such as the Framingham heart study in the United States &the Procamm study in the Europe have found that low HDL cholesterol is independently associated with increased risk for coronary artery disease [15]. Patients with low HDL cholesterol levels(less than 40mg/dl in men & less than 50mg/dl in women) are at increased risk of coronary heart disease [16].HDL cholesterol transports, excess cholesterol from peripheral tissues to the liver for excretion, a process known as reverse cholesterol transport. In addition HDL cholesterol inhibits the oxidation of LDL cholesterol & the expression of cellular adhesion molecules & monocyte recruitment &it may reduce the risk of thrombosis by inhibiting platelet activation &aggregation [17].

4. Diabetes Mellitus:

There is increased incidence of large vessel atherosclerosis &myocardial infarction in patients with insulin &non insulin dependent diabetes mellitus. Coronary artery disease is the most common cause of death in adults with DM. Diabetes mellitus is an independent risk factor for coronary artery disease &the incidence of coronary artery disease is related to the duration of diabetes. In patients with DM, myocardial infarction is not only more frequent but also tend to be larger in size, more likely to result in complications such as heart failure, shock& death [18]. The increase in morbidity appears related to the synergistic effect of hyperglycemia with other cardiovascular risk factors. Risk factors for macrovascular disease in diabetic individual include dyslipidemia , hypertension, obesity, reduced physical activity &cigarette smoking.Insuline resistance is reflected by elevated serum insulin level ,is associated with an increase risk of cardiovascular complication in individual with or with out diabetes mellitus. Individual with insulin resistance type 2 DM have elevated level of plasminogen activator inhibitor especially PAI type 1, and fibrinogen which enhance the coagulation process &impair fibrinolysis, that favoring the development of thrombosis [19].

5-Hypertension:

The relationship between insulin resistance and hypertension is well established. Paradoxically, under normal physiologic conditions, insulin is a vasodilator with secondary effects on sodium reabsorption in the kidney. However, in the setting of insulin resistance, the vasodilatory effect of insulin is lost, but the renal effect on sodium reabsorption is preserved. Sodium reabsorption is increased in Caucasians with the metabolic syndrome but not in Africans or Asians. Insulin also increases the activity of the sympathetic nervous system, an effect that may also be preserved in the setting of the insulin resistance. Finally, insulin resistance is characterized by pathway-specific impairment in phosphatidylinositol 3-kinase signaling. In the endothelium, this may cause an imbalance between the production of nitric oxide and secretion of endothelin-1, leading to decreased blood flow. Although these mechanisms are provocative, insulin resistance contributes only modestly to the increased prevalence of hypertension in the metabolic syndrome [20]

Hyperinsulinemia can increase arterial pressure by one or more of four mechanisms. First, hyperinsulinemia produces renal Sodium retention (at least acutely) and increases sympathetic activity. Either or both of these effects could lead to an increase in arterial pressure. Another mechanism is vascular smooth-muscle hypertrophy secondary to the mitogenic action of insulin.

Third, insulin also modifies ion transport across the cell membrane, thereby potentially increasing the cytosolic calcium levels of insulin-sensitive vascular or renal tissues.

Finally, insulin resistance may be a marker for another pathologic process, e.g., nonmodulation, which could be the primary mechanism increasing blood pressure. It is important to point out, however, that the role of insulin in controlling arterial pressure is only vaguely understood, and, therefore, its potential as a pathogenic factor in hypertension remains unclear [21].

Patients and methods:

This study is based on New National Cholesterol Education Program (NCEP), Adult Treatment Panel III which approved the criteria of metabolic syndrome .

Study design and patients:

The patients included in this cross – sectional study were 48 patients (of both sexes) aged 43-81 year presented with myocardial infarction who were admitted to the coronary care unite at Al-Sadr teaching hospital in Najaf city from first of December 2006 to thirty November 2007.They were screened for MS criteria.

Laboratory methods:

1- Serum TG and HDL measurement:

The measurement done by enzymatic determination of TG and HDL in the serum by using kits manufactured by randox laborite's ltd, USA.

Procedure:

To ensure accurate lipid profile measurement in first 24 hours of STEMI , 3 ml of fasting venous blood were collected in the next morning , then centrifuged for 5-10 minutes at 37 c° and by using spectrophotometery at wave length of 500 nm , TG and HDL were measured.

2-Blood glucose measurement:

This was done by enzymatic colorimetry (god-pap) method by drawing one ml of venous blood after fasting for eight hours because the inclusion criteria of MS is impaired fasting glucose. Measurement was done by mixing with specific reagent and incubating for 10 minutes at 37c° or 30 minutes at 20-25c° with wave length similar to triglyceride and HDL measurement but, with kits manufactured by Biolabo, Maizy, France.

3-waist circumference:

The waist was measured using a non-stretchable fiber measuring tape. The subjects were asked to stand erect in a relaxed position with both feet together on a flat surface; one layer of clothing was accepted. Waist girth was measured as the smallest horizontal girth between the costal margins and the iliac crests at minimal respiration[22].

4-blood pressure measurement: this was done by using mercury sphygmomanometer in either arm when the patient relaxed in supine position and the arm at the level of the heart.we apply the cuff to the upper arm with the center of the bladder over the brachial artery .Inflation of the bladder was done until the brachial pulse is impalpable then continue inflation of the cuff for another 10 mmHg ,when the pulse become impalpable ,then deflate the cuff slowly until regular sound ,are first heard and this reading is the systolic blood pressure and then continuation of deflation until the sound disappear which represent the diastolic blood pressure.

Statistical analysis (cross sectional study):

Statistical analysis done by using statistical package for social studies (SPSS 15) association between different variables were measured by using the T-test.P value of < 0.05 considered as level of statistically significant .

Results:

In this study the total number of patients was 48 patients with acute MI, 21 (43.8%) of them found to have constellation of MS criteria while 27 (56.2%) of them were considered as Non- MS as shown in table (1).

Table (1) The prevalence of metabolic syndrome in MI patients

	NO.	PERCENT
Metabolic syndrome patients	21	43.8
Non-metabolic syndrome patients	27	56.2
Total	48	100%

Table (2) shows the gender distribution of cases in MS.

	MS	PERCENT
Male	10	48
Female	11	52
Total	21	100

Table (3) shows the prevalence of metabolic syndrome in each sex.

	M S		Non-MS		Total
	No.	%	No.	%	
Male	10	37	17	63	27
Female	11	52	10	48	21

The MS was more prevalent in females than males which was (52%), (11 of 21) in female patients & (37%) in male patients (10 of 27).

Table (4) shows the mean of age of both groups (MS and Non-MS patients. There was no significant difference between the two groups.

	Range of ages	Mean	SD	P-value
MS	43-72	58.42	8.72	0.692
Non-MS	45-81	57.44	8.31	0.694

Table (5) shows the range and mean of ages of both sexes in MS patients. The difference between the two groups is of no significance.

	NO.	Range	Mean	SD	P-value
Male	10	46-72	58.29	9.14	0.68
Female	11	43-71	56.20	8.41	0.54

Table (6) shows the factors that constitute the MS and their percentage in both MS and Non-MS patients.

Variables	MS patients (21)	NON-MS patients (27)
Obesity (wc) Male >102 cm Female >88 cm	76%	26%
TG≥150 mg/dl	57%	29%
HDL	66%	33%

Male <40 mg/dl Female <50 mg/dl		
Blood pressure ≥ 130/≥ 85 mm Hg	71%	41%
Fasting glucose ≥110 mg/dl	62%	33%

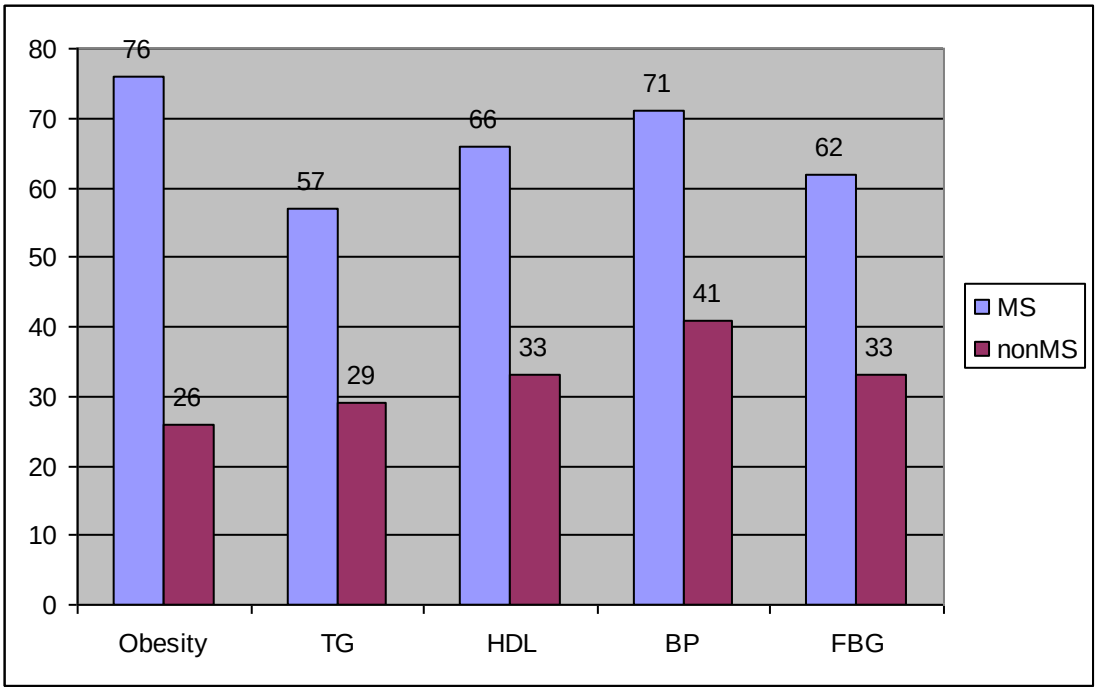

Figure (3) shows the percentage of each variable in both MS and Non-MS

Table (7) shows the comparison of MS criteria for both MS and Non-MS patients. There was significant difference in waist circumference and systolic blood pressure and fasting blood glucose.

	MS			NON-MS			P-value
	No.	Mean	SD	NO.	Mean	SD	
Wc (cm)	21	99	13.1	27	90	10.3	0.014*
TG mg/dl	21	142	23.7	27	132	22.9	0.15
HDL mg / dl	21	41.47	6	27	43.14	7.8	0.15
SBP mmHg	21	138	22.9	27	124	19.3	0.026*
DBP mmHg	21	80	14.6	27	76	13.6	0.38
FBS mg/dl	21	129	23.4	27	108	28.3	0.024*

*Statistically significant difference

Discussion:

Metabolic syndrome studies were many in both normal population & patients with atherosclerotic diseases like CAD, PAD, &cerebral artery disease.Regarding CAD many studies were done on the prevalence of metabolic syndrome by using NCEP ATP III criteria & other criteria (like IDF,WHO,AHA criteria).

In present study the prevalence of MS in patients with acute MI was 43.8% & it was relatively comparable to other studies.

In a study conducted by SMART study group of doctors in Utrecht university medical centre in Netherland on 527 patients with CAD & found that prevalence of MS according to NCEP ATPIII criteria was 41%. [23]

In coronary artery disease in Saudi study (CADISS) ,MS was prevalent in 40.9% of patients with CAD. [24] In Indian study , 475 patients aged (40-75) years with acute coronary syndrome were screened for criteria of MS according to ATP III . The prevalence of MS was 40.1% of patients. [25] Regarding prevalence of sex, the results showed increased prevalence of MS in females than males (52%) versus (37%).Smart study group study showed that MS also was more prevalent in females than males (60%) versus (37%) [23] .Indian study showed prevalence of MS in females was (46.5%) & in males (36.4). [25] The predominance of female may be due to difference of the diagnostic criteria for the MS between men and women i.e in waist circumference and HDL cholesterol. [23] Regarding the prevalence of MS risk factors, in this study, obesity was found to be the most frequent factor (76%) &followed by elevated blood pressure(71%),while in (SMART) study group, elevated blood pressure was the more prevalent risk factor about (61%) [23],while in (CADISS) study and Indian study ,low HDL was the most prevalent risk factor of MS[24] ,[25].

Conclusion

The study showed the association and importance of MS as afrequent cause of CAD, making identification & treatment of risk factors of MS is one of the preventive approach to CAD in the future.

References :

1- Boon N,Colldge N,Walker B,et al.Davidson's principles and practice of Medicine.Churchil Livingstone.20th edition 2006 ;p 581

2-Mark stolaro.Metabolic syndrome .Cleveland clinic journal of medicine 2007; 74:199-208.

3- Clark L, Atat F.Metabolic syndrome in Africans Americans.Clinical cardiology 2007;30:161-164.

4- Isoma B, Almgren P, Tuomi T, et al.Cardiovascular morbidity and mortality associated with the metabolic syndrome .Diabetes care 2001; 24:683-689.

5- Stern M, Williams K, Gonzale C, et al.Does the metabolic syndrome improve identification of individuals at risk of type 2 diabetes and/ or cardiovascular disease? Diabetes care 2004; 27:2676-2681.

6-National cholesterol education program: Executive summary of the third report of the National Cholesterol Education Program (NCEP) ATP (III).JAMA 2001; 285:2486-2497.

7-Kim F, Philip P, Henrey P.Taking vascular disease beyond convention. British Journal of cardiology 2002; 9; 1-16

8-Poivier P,Giles TD,Brony GA,et al.Obesity and the cardiovascular disease:pathophysiology,evaluation,and effect of weight loss.Circulation 2006;113:898-918.

9-Yusuf S,Movas,Pais P.Tackling the challenge of the cardiovascular disease burden in developing countries.Am Heart J.2004;148:1-4.

10-Flier J, Flier E.Obesity.Harrison's principle of internal medicine.McGraw-Hill.16th edition.2005:422-429.

11-Austin M.Plasma triglyceride and coronary heart disease arterisclerosis.Thromb.1999; 11:2-4.

12-Hokanson J, Austin M.Plasma triglyceride is a risk factor for cardiovascular disease independent of HDL cholesterol .Journal of cardiovascular Risk 1996; 3:213-219.

13-Manuinen V,Tenkanen L,Koskinen P,et al.Joint effect of serum TG,LDL cholesterol & HDL cholesterol concentration on CHD risk in the Helsinki Heart Study .Circulation 1992;85:37-45.

14-Brunner D,Altman S,Lobel K,et al.The bezafibrate infarction prevention (BIP).Secondary prevention by raising HDL cholesterol & reducing TG in patients CHD.Circulation 2000;102:21-27.

15-Gordon D,Rifkind B.HDL.NEng JMed.1989;321:1311-1316.
16-Ashen M,Roger S.Low HDL cholesterol levels.The New Eng J of medicine 2005;353:1252-1259.
17-Shan P,Kaul S,Cercek B.Exploiting the vascular protective effects of HDL & its apolipoproteins .Circulation 2001;104:2376-2383.
18-Wilson S, Eolncci, Daniel T. Cardiac tumours, cardiac manifestations of systemic diseases. Harrison's principles of internal medicine. McGraw-Hill .16th edition .2005;223:1420-1425.
19-Alvin C, Powers. Diabetes Mellitus. Harrison's principles of internal medicine .McGraw-Hill .16th editin 2005;323:2152-2180.
20-Robert H. The metabolic syndrome. Harrison's principles of Internal medicine. McGraw-Hill .17th edition 2008;236:236-1-236-5.
21-Dennis L, Anthony S, Danl, et al. Hypertensive vascular disease. Harrison's principles of Internal medicine. McGraw-Hill.16th edition 2005;230:1463-1481.
22-Deepa M,Farooq S,Datta M ,et al .prevelance of metabolic syndrome using WHO , ATPIII and IDF definitions in Asians Indians. Diabetes- M etab Res Rev 2007; 23: p 127-134
23-Petra G,Jobien O,Yolanda G,et al.Prevalence of metabolic syndrome in patients with coronary heart disease,cerebrovascular disease,peripheral arterial disease or abdominal aortic aneurysm.Atherosclerosis 2004;173:363-369.
24-Tawfik AH.Stratgic approaches of the chronic diseases among GCC countries, Mediterranean conference on general medicine ,2006,p 11.
25- Ramachandran A, Sehalatha C , Satyavani K , et al.Metabolic syndrome in Asian Indian patients with ischemic heart diseases using ATP III criteria.Diabetes-Res-Clin-Practice 2003 ;60(3):199-204.