METABOLIC SYNDROME AND CORONARY HEART DISEASE IN ADULT PATIENTS ABOVE 45 YEARS

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ABSTRACT

Objectives: **To study the association between metabolic syndrome components and ischemic heart disease (IHD) in both sexes.**

Patients & Methods: **A total of 1387of adult in-patients attending three different hospitals were studied. Clinical examination and specific investigations to clarify the incidence of a central metabolic factor (body mass index BMI, high serum triglycerides TG and low high density lipoprotein HDL), a glucose factor and a blood pressure factor were carried out. The presence of metabolic syndrome was defined as the presence of three or more risk factors.**

Results: **There were significant positive association between IHD defined by resting electrocardiogram (ECG) criteria and the components of metabolic syndrome including obesity, elevated blood pressure, fasting and post challenge hyperglycemia, high TG and an inverse significant association with HDL cholesterol. Metabolic syndrome was present in 48% of studied IHD patients, with clear predominance of females 60%. Hypertension was the commonest risk factor in both males and females (82%), obesity 57%, diabetes 20%; both more common in females. High triglycerides present in 35%, while low HDL in 23%. These results support the thesis that the metabolic syndrome exerts effects through different risk factors by different mechanisms.**

Conclusions: **the metabolic syndrome is common among ischemic heart disease patients and is related to modifiable risk factors.**

INTRODUCTION

Metabolic syndrome (MS) is characterized by a group of metabolic risk factors in one person; The National Education Program in the USA defines the metabolic syndrome as three or more of five abnormalities[1]:

1. **Waist circumference of > 40 inches (102cm) for males and > 35 inches (88cm) for females.**
2. **Triglycerides level of > 150 mg/dl.**
3. **High density lipoprotein cholesterol of < 40 mg/dl in men or < 50 mg/dl in women.**
4. **Blood pressure of > or = 130/85 mmHg.**
5. **Fasting glucose of > or = 110 mg.**

Metabolic syndrome is related to insulin resistance, but the two terms are not synonymous, both are associated strongly with obesity. The MS is important as an indicator of increased risk of cardiovascular disease in patients with or without IHD. The presence of MS in patients with IHD increases the risk of cardiovascular disease and complications, greater than that conferred by any single risk factor. Since risk factors tend to cluster, if one component of the MS is present, one should assess for other risk factors. People with the MS are at increased risk of other diseases related to plaque buildups in artery walls *(e.g. stroke and peripheral vascular disease)*. The MS has become increasingly common in the United States, it's estimated that over 50 million Americans have it[2,3]. A large segment of the adult population of industrialized countries develop the MS. The most commonly recognized risk factors in the syndrome are highly correlated with each other and are presumed to reflect common metabolic pathways. The MS is also predictive of new onset type 2 diabetes, early diagnosis provides justification for measures that can improve components of the syndrome and reduce the IHD risk. The management strategies for MS focuses on overall IHD risk factors rather than single factor Effective therapy includes priority for weight reduction and increased physical activity. Pharmacotherapy is typically needed for control of high blood pressure, hypercoagulability and increased levels of blood glucose and triglycerides[4,5].

Objective

To estimate the prevalence of the metabolic syndrome among adult in-patient and to examine the association between the 1HD and each of the components of the metabolic syndrome.

PATIENTS AND METHODS

This study is based on 1387 subjects aged 45-75 years (533 men and 854 women), who attended three different hospitals in Basrah. A standard medical and behavioral interviews were made

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and a physician diagnosis of high blood pressure was ascertained. Height and weight were measured with participant wearing light clothing and no shoes. Body mass index was calculated as weight (kg)/height ($m^{2)}$. Blood pressure was measured according to the hypertension detection and follow-up program protocol by using a standard mercury sphygmomanometer after the subject had been seated for at least 5 minutes. The mean value of two measurements taken at least 1 minute apart was used in the analysis. Plasma glucose levels were measured by glucose oxidase assay. Total plasma cholesterol and Triglycerides were measured by enzymatic techniques, HDL cholesterol was measured according to the standardized procedures of the lipid research clinic' protocol, low density lipoprotein cholesterol (LDL cholesterol) was estimated. A 12-lead resting ECG was recorded. Because antihypertensive medication can cause metabolic side effects resembling the pattern in the metabolic syndrome, analysis were repeated after excluding all known antihypertensive medications. The American heart and the national heart, lung and blood institute recommend that the metabolic syndrome be identified as the presence of three or more of these Components[6]:

1. *Elevated waist circumference; men = or greater than 40 inches (102cm), women = or greater than 35 inches (88cm).*
2. *Elevated Triglycerides; equal or more than 150mg/dl.*
3. *Reduced HDL ('good') cholesterol; men less than 40 mg/dl, women less than 50 mg/dl.*
4. *Elevated blood pressure; equal to or greater than 130/85mmHg.*
5. *Elevated fasting glucose*; *equal to or greater than 100mg/dl.*

*Z and Chi squired tests were used for statistical analysis, P-value < 0.05 was taken as the minimal level for significant.

RESULTS

Prevalence of metabolic syndrome

One thousand three hundred eighty seven patients (1387) were studied, 533(38.4%) males and 854(61.6%) females. Metabolic syndrome was seen in 256 (18.5%) of patients, 62(11.7%) of males and 194(22.7%) of females. (P< 0.05) Table-l.

Table l. ***Prevalence of metabolic syndrome among all studied adult patients according to the sex.***

	Male No. %	Female No. %	Total No. %	P-value
Metabolic syndrome	62 (11.7%)	194 (22.7%)	256 (18.5%)	< 0.05
No metabolic syndrome	471 (88.3%)	660 (77.3%)	1131 (81.5%)	-
Total	533 (38.4%)	854 (61.6%)	1387 (100%)	-

Prevalence among ischaemic heart disease patients

Table-2 shows the prevalence of metabolic syndrome among IHD patients 104 (48%), of the patients had metabolic syndrome with significant difference between males (30%) and females (60%). P < 0.05

Table 2. Prevalence of metabolic syndrome among studied IHD patients according to the sex.

	Male No. %	Female No. %	Total No. %	P-value
Metabolic syndrome	26 (30%)	78 (60%)	104 (48%)	< 0.05
No metabolic syndrome	60 (70%)	51 (40%)	111 (52%)	-
Total	86 (40%)	129 (60%)	215 (100%)	-

Prevalence among non IHD patients

Table-3 shows the prevalence of metabolic syndrome among non IHD patients 152(13%), the prevalence rate was 8.1%) among males and 16% among females. The difference was statistically significant (P<0.05).

Table 3. Prevalence of metabolic syndrome among all studied adult patients according to the sex.

	Male No. %	Female No. %	Total No. %	P-value
Metabolic syndrome	36 (8.1%)	116 (16%)	152 (13%)	< 0.05
No metabolic syndrome	411 (91.9%)	609 (84%)	1020 (87%)	-
Total	447 (38%)	725 (62%)	1172 (100%)	-

Components of the metabolic syndrome

Table-4 shows the distribution of the different components of metabolic syndrome among IHD patients. Hypertension was present in 178(82%) of patients, males 66(67%) as compared to 112(86%) of female patients. (P<0.05). Diabetes was present in 43(20%) of patients, males 8(9%) as compared to 35(27%) of females patients (P<0.05). Obesity was present in 124(57%), males 32(37%) as compared to 92(71%) of females patients (P<0.05). High level TG was present in 76(35%), males 21(24%) as compared to 55(42%) of females patients (p <0.05). Low level HDL was present in 50(23%), males 13(15%) as compared to 37(28%) of females patients (P<0.05).

Table 4. Distribution of the different component of metabolic syndrome among IHD patients.

	Male No. %	Female No. %	Total No. %	P-value
Hypertension	66 (76)	112 (86)	178 (82)	< 0.05
Diabetes mellitus	8 (9)	35 (27)	43 (20)	< 0.05
obesity	32 (37)	92 (71)	124 (57)	< 0.05
High TG	21 (24)	55 (42)	76 (35)	< 0.05
Low HDL	13 (15)	37 (28)	50 (23)	< 0.05
Total	86 (40)	129 (60)	215 (100)	-

Table-5 shows the distribution of the different components of metabolic syndrome among non IHD patients, hypertension was present in 418(35.6%) of patients, males 131(29.3%) as compared to 287(39.58%) of female patients. (P<0.05). Diabetes was present in 179(15.2%) of patients, males 50(11.1%) as compared to 129(17.79%) of females patients (P<0.05). Obesity was present in 286(24.4%), males 65(14.5%) as compared to 221(30.4%) of females patients (P<0.05). High level TG was present in 118(10%), males 32(7.1%) as compared to 86(11.8%) of females patients (P<0.05). Low level HDL was present in 56(4.77%), males 18(4%) as compared to 38(5.2%) of females patients (P<0.05). Adult non IHD patients without any detectable risk factor were present in 662(56.48%), males 284(63.5%) as compared to 378(52.1%) of females patients.

Table 5. Distribution of the different component of metabolic syndrome among non-IHD Patients.

	Male No. %	Female No. %	Total No. %	P-value
Hypertension	131 (29.3)	287 (39.58)	418 (35.6)	< 0.05
Diabetes mellitus	50 (11.1)	129 (17.79)	179 (15.2)	< 0.05
obesity	65 (14.5)	221 (30.4)	286 (24.4)	< 0.05
High TG	32 (7.1)	86 (11.8)	118 (10.0)	< 0.05
Low HDL	18 (4)	38 (5.2)	56 (4.77)	< 0.05
No risk factor	284 (63.5)	378 (52.1)	662 (56.48)	< 0.05
Total	447 (38.1)	725 (61.9)	1172 (100)	-

Table-6 shows the prevalence of one or more abnormalities of metabolic syndrome among IHD, 11.6% of patients had all the 5 elements of MS, 4 metabolic abnormalities were seen in 19.5% of patients, 3 metabolic abnormalities were seen in 17.2%, 2 metabolic abnormalities seen in 27.4 of patients. Single metabolic abnormality was seen in 15.8% of patients and only 8.3% of patients had no metabolic abnormalities what so ever. In all these, the differences were statistically significant between males and females ($P<0.05$).

Table 6. Prevalence of one or more abnormalities of metabolic syndrome among IHD patients.

Number of metabolic factors	Male No. %	Female No. %	Total No. %	P-value
0	13 (15.1)	5 (3.8)	18 (8.3)	< 0.05
1	22 (25.5)	12 (9.3)	34 (15.8)	< 0.05
2	25 (29)	34 (26.3)	59 (27.4)	< 0.05
3	7 (8.2)	30 (23.3)	37 (17.2)	< 0.05
4	10 (11.6)	32 (24.8)	42 (19.5)	< 0.05
5	9 (10.4)	16 (12.4)	25 (11.6)	< 0.05
1-5 risk factors	73 (84.8)	124 (96.1)	197 (91.6)	< 0.05
Total	86 (40)	129 (60.0)	215 (100)	-

DISCUSSION

Metabolic syndrome is a multifaceted syndrome, which occurs frequently in the general population. A large segment of the adult population of industrialized countries develops MS, produced by genetic, hormonal and life style factors such as obesity, physical inactivity and certain nutrient excesses[7]. Insulin resistance is proposed to be the underlying or driving mechanism for the MS and is often associated with dyslipidemia, essential hypertension, abdominal (visceral) obesity, glucose intolerance or non-insulin dependent diabetes mellitus, all of these factors accumulate cardiac risk factors. Cardiovascular disease remains the major cause of death all over the world[8]. In this cross sectional study, 18.5% of the adult patients (IHD and non-IHD) had MS, more in female 22.7% compared to males 11.7%, this pattern was similar to other studies[9,10]. Also this study shows a high prevalence of metabolic syndrome among IHD patients compared to non IHD patients; 48%

and 13% respectively, female were predominant in both studied groups; 60% and 16%, possibly because of their diet and limited physical exercise , this was similar to other studies[10,11]. This study showed that hypertension was the commonest risk factor distributed among IHD patients 82%, slightly more in females 86% compared to males 76%, this was higher than reported in other studies[11,12], possibly because hypertension is common in our community and badly controlled in large number of patients[12]. Also in this study, 20% of IHD patients had diabetes, clearly higher in females 27% compared to males 9%, this was lower than the figures reported in other studies[13,14]. Diabetes mellitus accelerates atherosclerosis and increases the risk of angina, myocardial infarction, and death[14]. (Table-4) also showed 57% of patients had obesity, 71% of females had a high percentage of increasing body weight as compared to 37% of males, which was higher than in other studies[15,16]. Obesity especially visceral adiposity, is a major determinant of the development of type 2 diabetes. Both visceral adiposity and insulin resistance are strongly related to cardiovascular risk factors in diabetes and non-diabetes subjects[16]. High triglycerides (TG)/ low high density lipoprotein (HDL) cholesterol are both strong risk factors of IHD in subjects without clinical cardiovascular disease, this study shows 35% of IHD patients had high TG, while HDL were low in 23%, both items were more in females. This was lower than findings in other studies[17,18] possibly because of use of antihyperlipidemic drugs and awareness to diets[19,20]. Table-5 shows that hypertension was the most frequent risk factor in non-IHD patients (36.6%), followed by obesity (24.4%), diabetes (15.2%), high TG (10%), low HDL (4.77%), with females predominance in all components of metabolic syndrome, especially obesity, this was approximately similar to other studies[20,21]. A wide spread of IHD risk factors and a low awareness of their implication were found in the population[22,23]. The results showed that 91.6% of IHD patients had one or more of the risk factors with slight females' predominance. A single risk factor was present in 15.8% more in males, two factors in 27.4%, three factors in 17.2%, four factors in 19.5%, while the fifth metabolic factors were present in 11.6%, this was slightly lower than results reported in other studies[22,23]. From three risk factors and above, females were more predominant in the frequency of occurrence of metabolic syndrome; this was similar to other studies[24,25].

Recommendations

In the light of our results, we highly recommend an educational programme to emphasize the following:

1. **Weight control to achieve a desirable weight (BMI <25 kg/M2).**
2. **Increased physical activity, with a goal of at least 30 minutes of moderate intensity activity on most days of the week.**
3. **Healthy feeding habits that include reduced intake of saturated fat and cholesterol.**

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REFERENCES

1. **National institutes of health, third report of National Cholesterol Education program Expert Panel on Detection, Evaluation and treatment of High blood cholesterol in adults. Bethesda, Md: National institutes of health; 2001. NIH Publication No. 01-3670.**
2. **Vorob'eva, EN, Varshavaskii Bia, Tushev AN, Ivanova TV. Relation ship of different risk factors of ischemic heart disease. Vestn-Ross-Akad-Med-Nauk. 2001; (2): 31-34**
3. **Timar O, Sestier F, Levy E. Metabolic syndrome X.Can-J-CardioL 2000; 16(6):77989.**
4. **Lissner L, Heitmann BL, Bengtsson C. Population studies of diet and obesity. BrJ-Nutr. 2000; 83 suppl 1: 521-524.**
5. **Norden-Lindeberg S, Hanson U. Hypertension and factors associated with metabolic Syndrome at follow up at 15 years in women with hypertensive disease during first pregnancy. Hypertens-pregnancy. 2000; 19(2): 191-198.**
6. **Lazarus R, Sparrow D, Weiss S. Temporal relations between obesity and insulin: longitudinal data from the Normative Aging Study. Am J Epidemiol 1998; 147: 173-179.**
7. **Liese AD, Mayer-Davis EJ, Haffner SM. Development of the multiple metabolic syndromes: an epidemiologic perspective. Epidemiol Rev 1998; 20:157-172.**
8. **Lamarche B, Desroches S. Metabolic syndrome and effect of conjugated linoleic acid in obesity and lipoprotein disorders: the Quebec experience. Am-J-Clin-Nutr. 2004; 79(6 suppl): 1149S-1152S.**
9. **Zarate A, Basurto L, Hernandez M. The metabolic syndrome in postmenopausal women. Clinical**

implications. Gac-Med-Mex. 2003 Nov-Dee; 139(6): 625-628.
10. Yilmaz MB, Biyikoglo SF, Akin Y, Guray U, Kisacik HL, Korkmaz S. Obesity is associated with impaired coronary collateral vessel development. Int-J-Obes-Relat-Metab Disord. 2003; 27 (12): 1541-1545.
11. Lakka HM, Laaksonen DE, Lakka TA, Niskanen LK, Kumpusalo E, Tuomilehto J, et al. The metabolic syndrome and total and cardiovascular disease mortality in middle-aged men. JAMA 288: 2909-2916, 2002.
12. Hanson RL, Imperatore G, Bennett PH, Knowler WC. Components of the "metabolic syndrome" and the incidence of type 2 diabetes. Diabetes 51: 3120-3127, 2002.
13. Pyorala M, Miettinen H, Halonen P, Laako M, Pyorala K. Insulin resistance syndrome predicts the risk of coronary heart disease and stroke in healthy middle aged men: the 22-year follow-up results of the Helsinki Policemen Study. Arterioscler Thromb Vasc Biol 20: 538-544, 2000.
14. Zimmet P, Boyko EJ, Collier GR, de Courten M. Etiology of the metabolic syndrome: potential role of insulin resistance, leptin resistance, and other players. Ann N Y Acad Sci 892:25-44, 1999.
15. Everson SA, Lynch JW, Kaplan GA, Lakka TA, Sivenius J, Salonen JT. Stress induces blood pressure reactivity and incident strok in middle age men. Stooke. 2001 Jun; 32 (6): 1263-70.
16. Chambless LE, McMahon RP, Brown SA, et al. Short-term intraindividual variability in lipoprotein measurements: The Atherosclerosis Risk in Communities (ARIC) Study. Am J Epidemiol 1992; 136: 1069-1081.
17. Nabulsi AA, Folsom AR, Heiss G, et al. Fasting hyperinsulinemia and cardiovascular disease risk factors in nondiabetic adults: stronger associations in lean versus obese subjects. Metabolism 1995; 44:914-922.
18. Folsom AR, Burke GL, Ballew C, et al. Relation of body fatness and its distribution cardiovascular risk factors in young blacks and whites: the role of insulin. Am J Epidemiol 1989; 130:911-924.
19. Kekalainen P, Sarlund H, Laakso M. Long-term association of cardiovascular risk factors with impaired insulin secretion and insulin resistance. Metabolism 2000; 49:1247-54.
20. Everson SA, Goldberg DE, Helmrich SP, et al. Weight gain and the risk of developing insulin resistanceEverson SA, syndrome. Diabetes Care 1998; 21:1637-1643.
21. Boden G. Pathogenesis of type 2 diabetes. Insulin resistance. Endocrinol Metab Clin North Am 2001; 30:801-815.
22. DeFronzo RA, Ferrannini E. Insulin resistance. A multifaceted syndrome responsible for NIDDM, obesity, hypertension, dyslipidemia, and atherosclerotic cardiovascular disease. Diabetes Care 1991; 14:173-194.
23. Ferrario M, Carpenter MA, Chambless LE. Reliability of body fat distribution measurements. The ARIL Study baseline cohort results. Atherosclerosis Risk in Communities Study. Int J Obes Relat Metab Disord 1995; 19: 449-957.
24. Ryan AS. Insulin resistance with aging: effects of diet and exercise. Sports Med 2000; Nov 30:327-346.
25. The ARIC Investigators. The Atherosclerosis Risk in Communities (ARIL) Study: design and objectives. Am J Epidemiol 1989;129:687-702