

METABOLIC SYNDROME IN TYPE-2 DIABETES MELLITUS

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ABSTRACT

Objective: To find out the prevalence of metabolic syndrome in type-2 Diabetes Mellitus and its cardiovascular affects using the guide lines of WHO (World Health Organization) and NCEP (National Cholesterol Education Program).

Patients and Methods: Six hundred eighty patients were selected on a random sample basis from those suffering from Diabetes Mellitus Type-2 from January 2004 to May 2005, at the Ziauddin Medical University Hospital and Consultation Clinic.

Result: Six hundred eighty patients were screened and their mean age was 58 years with 374 (55%) being males and 306 (45%) being females. Their mean duration of Diabetes Mellitus was observed to be 13 years. Three hundred twelve (46%) were found to be of Metabolic Syndrome. Out of this 143 were found to have cardiovascular events.

Conclusion: Early diagnosis, treatment and prevention of Diabetes Mellitus Type-2 and Metabolic Syndrome present a major challenge for health care professional facing an epidemic of over-weight and sedentary life-style.

KEY WORDS: Diabetes Mellitus Type-2, Hypertension, Obesity, Dyslipidemia.

Pak J Med Sci July - September 2006 Vol. 22 No. 3 295-299

INTRODUCTION

The incidence and prevalence of Diabetes Mellitus have been increasing steadily in Pakistan. It is one of the five leading causes of death in most countries of the world. In Pakistan, about 9 million people are suffering from this disease. The WHO predicts that the current diabetic population of 130 million people will increase to 300 million by the end of 2025.^{1,2} This is equivalent to an increase from 2.1% to 3% of the world population by the year 2010.³

Diabetes is the most feared disease because it leads to a variety of complications including end-stage vascular disease, cardiovascular damage and retinal abnormalities. As a consequence, a large burden is put on the National Health System of all countries around the world.

This syndrome is characterized by insulin resistance and is also known as the insulin resistance syndrome. A large body of evidence has demonstrated that type-2 diabetes is a major risk for cardiovascular disease more in men and particularly older women. Himsworth recognized insulin sensitive and insulin resistance subtypes of diabetes.⁴ Reaven and his colleagues made an extensive study on insulin resistance.⁵ In 1988 they introduced a term of Syndrome-X for the collective name of cardiovascular disease, dyslipidaemia, obesity, hypertension and glucose intolerance. So this syndrome has been given several names such as Metabolic Syndrome, Insulin resistance syndrome and deadly quartet.⁶⁻⁸ The metabolic syndrome, a concurrence of disturbed glucose and insulin metabolism, overweight and

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* Received for Publication: August 13, 2005

* Revision Accepted: January 26, 2006

abdominal fat distribution, mild dyslipidaemia and hypertension, is most important because of its association with type-2 diabetes mellitus and cardiovascular disease.⁹

NCEP DEFINITION:¹⁰ At least three of the following: Fasting plasma Glucose ³110mg/dL, Abdominal obesity,

Definition 1: Metabolic syndrome, NCEP definitions with waist girth >102cm.

Definition 2: Metabolic syndrome, NCE definition with waist girth >94cm. Serum triglycerides³ 150mg/dL, Serum HDL cholesterol <40mg/dL & Blood pressure³ 130/85mmHg or medication.

WHO DEFINITIONS:¹¹ Hyperinsulinemia (upper quartile of the non-diabetic population) or fasting plasma glucose ³110mg/dL AND at least 2 of the following: Abdominal obesity,

Definition 1: metabolic syndrome, WHO definition with waist-hip ratio >0.90 or BMI

³⁰ *Definition 2:* metabolic syndrome, WHO definition with waist girth³ 94 cm. Dyslipidemia (serum triglycerides ³150mg/dL or HDL cholesterol <35mg/dl). Hypertension (blood pressure³ 40/90mmHg or medication). All the patients were selected according to WHO definitions (at least 2 criteria must be fulfilled) for the study.

METHODS

A total of 680 patients were selected on a random sample basis from those suffering from Diabetes Mellitus Type-2. Among these, cases of metabolic syndrome were selected and studied (according to the WHO definition). Data on 374 males and 306 females, from 35 to 75 years of age, from the Ziauddin Medical University Hospital and Consultation Clinic, were selected from January 2004 to May 2005. Out of these 680 patients, 312 were found to be of metabolic syndrome (as defined by the WHO); Plasma Blood Glucose³ 110 mg/dL; waist-hip ratio >0.90 and BMI³ 30; Serum triglycerides³ 150 mg/dl and HDL Cholesterol <35 mg/dL; Blood Pressure³ 140/90 mm Hg with or without medication.

Blood pressure was measured with a random zero mercury sphygmomanometer. The mean

of six measurements (three while lying and three while standing) of Systolic and Diastolic blood pressure was used on different occasions. Regarding the assessment for obesity mean was taken, Body mass index (BMI) was calculated as weight in kilograms divided by the square of height in meters. Waist circumference was calculated as an average of two measurements taken after inspiration and expiration at the mid-point of the lowest rib and iliac crest. Waist hip ratio was defined as waist girth divided by hip circumference measured at greater Trochanter. For the assessment of blood and sugar dyslipidaemia, the patients were asked to fast 12-14 hours and then their blood samples were taken. For analysis, the samples were sent to the lab. The reading of fasting blood glucose level serum triglycerides, LDL, HDL cholesterol and serum cholesterol were recorded.

For the assessment of the effects on the cardiovascular system, ECG, chest X-ray, and echocardiography were carried out in the patients suffering from Metabolic Syndrome.

RESULT

The prevalence of Metabolic Syndrome and its complications in cardiovascular system were noted in patients of Diabetes Mellitus type-2. A total of 680 patients were screened and diagnosed with Diabetes Mellitus type-2. Their mean age was calculated as 58 years. The mean duration of Diabetes Mellitus was 13 years. Out of these 680 patients, 312 were found to be of Metabolic Syndrome. In these 312 (46%) patients 188 (50%) were males and 124 (41%) were females. Male-female ratio was 50:41 proving that the disease was more dominant in males.

Table-I: Prevalence of Metabolic Syndrome and its different components in type-2 diabetic patients.

<i>n</i> = 680	<i>Male</i> <i>n</i> =374 (55%)	<i>Female</i> <i>n</i> =306 (45%)	<i>Total</i>
Metabolic Syndrome	188 (50)	124 (41)	312 (46)
Obesity	96 (26)	108 (35)	204 (30)
Hypertension	251 (67)	145 (47)	396 (58)
Dyslipidemia	138 (37)	107 (35)	245 (36)

Obesity was noted in 204 (30%) patients, Hypertension in 396 (58%) patients, and Dyslipidemia in 245 (36%) patients. Obesity, Hypertension and Dyslipidemia were thus detected in most of the patients suffering from Diabetes Mellitus Type-2.

Waist-hip ratio (mean) was 0.94, Waist-girth (102 & 92cm. male and female respectively), and Body Mass Index was found to be 34. Mean Systolic and Diastolic Blood Pressure were found to be 160/96 respectively. Mean fasting blood sugar was 140 mg/dl. Serum Triglycerides (mean) was 210 mg/dl, LDL was found to be 169 mg/dl and HDL (mean) was 52 mg/dl. In this study the prevalence of cardiovascular disease was found to be 143/312 (46%), (84 males and 59 females). Among these patients, those of Angina Pectoris were 84/312 (27%) (48 males and 36 females), those of Acute Myocardial Infarction were 34/312(11%) (20 males and 14 females) and those of Congestive Cardiac Failure were 25/312 (8%) (16 males and 9 females). Increase in the abdominal girth and obesity with increased blood level of LDL and Hypertension proved to be life threatening since it resulted in cardiovascular disease.

DISCUSSION

Type-2 Diabetes Mellitus is growing fast in our community as a chronic and lethal disease.¹² It is likely that it will increase very

Table-II: Statistical data of different factors of Metabolic Syndrome

<i>METABOLIC SYNDROME</i>	
AGE (mean)	58 years
Systolic BP	160
Diastolic BP	96
Hypertension (mean)	160/96
Body Mass Index	34
Waist Girth (mean) (Male)	102 cm
Waist Girth (mean) (Female)	92 cm
Waist-hip ratio (mean)	0.94
Serum Triglycerides mg% (mean)	210 mg/dl
Serum Cholesterol mg% (mean)	264 mg/dl
LDL (mean)	169 mg/dl
HDL mg% (mean)	52 mg/dl
Fasting Blood Sugar mg% (mean)	140 mg/dl

rapidly in the near future. The metabolic syndrome accelerates both macro vascular and micro vascular complications. Most of the diabetic complications occur in association with hypertension. Cardiovascular complications account for up to 75% morbidity and mortality in patients with type-2 Diabetes Mellitus;¹³ but our study shows that the figure is only 46%.

The prevalence of hypertension in our patients is 58%. It is the most common prevalent factor of metabolic syndrome in type-2 Diabetes Mellitus and this single factor leads to CVD (Cardio Vascular Disease). Hypertensive diabetic patients have a greater risk of macro vascular and micro vascular complications than normotensive patients. The exact mechanisms underline the relations between hypertension and diabetes and show that they are complex and ill defined, but include genetic factor and metabolic abnormalities characteristic of diabetes. In our study, 46% of the patients were suffering from cardiovascular disease like angina pectoris, myocardial infarction and congestive cardiac failure due to metabolic syndrome. However our goal should be to control blood pressure and achieve a BP of d"135/85mm of Hg.

Death and disabilities are the major companions of Diabetes Mellitus Type-2 in relationship with stroke and LHD.¹⁴ So there are multiple risk factors involved in Diabetes Mellitus Type-2 which are obesity, hypertension and dyslipidaemia. Among these hypertension proves to be the highest risk factor in our study, followed by obesity and hyperlipemia.¹⁵ Hypertension is about twice more common in patients with metabolic syndrome than others. Hence hypertension, obesity and dyslipidemia must be intensively treated to minimize both morbidity and mortality.^{16,17}

Obesity is creating an alarming situation in the community associated with Diabetes Mellitus. In our study there is a trend of increasing generalized and abdominal obesity as abdominal girth is 102cm and BMI is 34, as shown in KUOPIO Heart Disease Risk Factor.¹⁸ As obesity increases the risk factor in metabolic syndrome CHD also increases. Physical

inactivity and increased weight result in obesity.

This syndrome is closely linked to a generalized metabolic disorder called insulin resistance in which the normal action of insulin is impaired. Excess body fat, particularly abdominal obesity and physical inactivity, promotes the development of insulin resistance. However some individuals are also generally pre-disposed for insulin resistance. Among 312 patients of metabolic syndrome, cardiovascular disease was found in 143 patients (46%). This study reveals an alarming situation as in BOTANICA STUDY.¹⁹ Diabetes Dyslipidemia is essentially atherogenic.

In this study high triglycerides, low HDL and high LDL in Diabetes Mellitus Type-2 are influencing in creating atherosclerosis in coronary circulation below normal. Thus it is causing CHD in more males than females due to probable release of Estrogen. This is the secondary type of Dyslipidemia due to Diabetes Mellitus in Metabolic Syndrome. To save the heart there should be a reduction of saturated fat by 7% and cholesterol in diet <200mg/day.

Our study shows an alarming situation regarding Metabolic Syndrome and its morbidity and mortality. It is increasing epidemically, so it should be controlled epidemically with respect to controlling (HTN) Hypertension, maintaining normal weight, regular physical exercise, dyslipidemic control, and lastly normal blood sugar control levels. US, Diabetes's Preventive Program suggests that even modest lifestyle intervention can have a major impact in decreasing the risk of diabetes in glucose intolerance individuals.^{20,21} Physical activity, weight loss and diet²² favorably effect component of Metabolic Syndrome at least in the relatively short term. Patients engaging in regular moderate exercise are less likely to develop (DM) Diabetes Mellitus. However randomized control trial shows that lifestyle intervention can prevent metabolic syndrome. The long-term effectiveness of such interventions clinically and at the population

level in the treatment and prevention of the Metabolic Syndrome and its consequences warrant further research.

CONCLUSION

Diabetes Mellitus is emerging in our country as a non-infectious epidemic disease. It should be controlled at the earliest, for those who are suffering and for those who are at risk. They should give up sedentary life style and perform regular physical activities. They should be encouraged to stop smoking and take a healthy diet containing low saturated and trans-fatty acids, and low in dietary cholesterol. They should take much more fiber. It should be controlled and propagated by media like newspapers, television, radio, as also by doctors and paramedical staffs and should encourage them to control diabetes mellitus.

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