Comparison of the Frequency of Metabolic Syndrome among Diabetic and Non-Diabetic Outpatients of a Tertiary Care Public Sector Hospital in Karachi

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Abstract

Objective: To compare the frequency of Metabolic Syndrome among diabetic and non-diabetic out-patients of a tertiary care hospital with increased waist circumference.
Methods: This cross-sectional study was conducted in Medical unit-II of Abbasi Shaheed Hospital, Karachi from September 2008 to January 2009. A total of 100 patients i.e. 50 diabetics and 50 non-diabetics were selected by non-probability, purposive sampling technique. After taking the informed consent, patients of age 30-50 years with waist circumference >102 cm in males and >88 cm in females non-diabetic and diabetic for three years were inducted in the study from out-patient department, while patients having ischaemic heart diseases, nephrotic syndrome and gestational diabetes were excluded. Blood sample was taken for lipid profile and blood glucose after 12 hours of fasting. Waist circumference in straight standing position was measured. Relevant information including age, sex, waist circumference, fasting blood glucose, lipid levels and diagnosis of Metabolic Syndrome were recorded on proforma by a physician and analyzed through SPSS-15.
Results: Among diabetics, 62% were males and 38% were females while in non-diabetics, 58% were males and 42% were females. Hundred percent diabetic patients had dyslipidaemia compared to 88% non-diabetics. Among diabetics, 88% were hypertensive while 34% non-diabetics were hypertensive. Sixty percent of diabetics and 28% of non-diabetics had metabolic syndrome (p = 0.001).
Conclusion: There was a significantly high proportion of Metabolic Syndrome with increased waist circumference in diabetic patients.
Keywords: Diabetes Mellitus, Metabolic Syndrome, Waist-hip Ratio. (AASH & KMDC 18(2):68;2013).

Introduction

The current era has seen the rise of computerization and mechanization, with improved transport resulting in changes in lifestyle from active to sedentary and thus making an enormous impact on human health[1]. The increase in Metabolic Syndrome has been moderately related to the achievements in public health during the 20th century, with people living longer owing to the elimination of many of the communicable diseases. Over the last two decades, focus on the Metabolic Syndrome has regularly increased, recognizing this as one of the major global public health challenges of recent times[2].

Metabolic Syndrome is characterized by a set of clinical criteria: insulin resistance, obesity, hypertension, and atherogenic dyslipidaemia[3]. Gerald Reaven in 1988 was the first scientist to name this cluster as syndrome X[4]. Metabolic Syndrome has been defined in different ways, however, the new global definition of metabolic syndrome by the International Diabetes Federation (IDF) allowed comparative worldwide studies[5].

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Metabolic Syndrome is a major risk factor for the development of type-2 diabetes mellitus and is responsible for the epidemics of cardiovascular disease in most of the world[6,7]. Insulin resistance is the basis of most, if not all of the features of this syndrome. Thus hyperinsulinaemia, glucose intolerance, type-2 diabetes mellitus (DM), hypertriglyceridaemia, and low HDL cholesterol concentrations could be accounted for by resistance to the actions of insulin on carbohydrate and lipid metabolism[8]. There are data to support the concept that insulin resistance or its associated hyperinsulinaemia are independent risk factors for cardiovascular disease, this association is yet to be confirmed in large scale, prospective clinical studies[7,9].

Obesity is also considered to be an important factor in the aetiology of the Metabolic Syndrome as it contributes to hyperglycaemia, hypertension, high serum cholesterol, low high density lipoprotein (HDL) cholesterol, insulin resistance, and its association with higher Cardiovascular Disease (CVD) risk[7]. Several studies have shown that central fat accumulation is a predictive feature of the Metabolic Syndrome[10]. In addition to general obesity, the distribution of body fat is independently associated with the Metabolic Syndrome in older men and women, particularly among those of normal body weight[11].

By means of different definitions, prevalence of the Metabolic Syndrome has been reported consistently to range from 10% to 40% in most western and eastern countries[3,6,12,13]. In the Epidemiological Survey of Urban Karachi, Pakistan, the prevalence of the Metabolic Syndrome was found to be 12%, 20%, and 27% using the WHO, Adult Treatment Panel (ATP) III report, and IDF definitions, respectively[14]. Estimation of the prevalence of the Metabolic Syndrome is essential for the prediction of the future load of type-2 DM and Cardiovascular Disease (CVD). It is therefore important that those individuals having Metabolic Syndrome should be identified and treated as early as possible. The objective of this study is to compare the frequency of Metabolic Syndrome among diabetic and non-diabetic patients with increased waist circumference. We believe that frequency of Metabolic Syndrome among diabetic patients with increases waist circumference is significant as compared to non-diabetic patients.

Patients and Methods

This cross sectional study was conducted in Medical unit-II of Abbasi Shaheed Hospital, which is a tertiary care public sector hospital of Karachi, Pakistan. The study was carried out from September 2008 to January 2009, with a sample size of 79 patients. The sample size was calculated by using the WHO software[15] where level of significance (%) α = 5, power of the test (%) 1 - β = 90, test value of the population proportion Po =0.34. Anticipated value of the population proportion Pa=0.50. Sample size n = 79. A sample of 100 patients was recruited to avoid the chances of type 2 error. The reference study used for sample calculation was from Imam SK et al.[11].

During the study period, a total of 100 patients, having age of 30-50 years, in which 50 were diabetics and 50 were non-diabetics were selected by non-probability, purposive sampling technique. The diabetic patients with greater than 3 years of diagnosis and non-diabetic patients with waist circumference >102 cm in males and > 88 cm in females attending the out-patient department of Medical Unit-II were included[16]. The patients having Ishaemic Heart Disease (IHD), nephrotic syndrome, gestational diabetes and familial hyperlipidaemia were excluded. Patient's presenting complaints and past history was inquired. General physical examination was done. Blood sample was taken for blood glucose and lipid profile after 12 hours of fasting. Waist circumference in straight standing position was measured. Blood pressure was also taken. Informed consent about these procedures was taken from the patients. Relevant information including age, sex, waist circumference, fasting blood sugar, lipid levels and diagnosis of Metabolic Syndrome was recorded by a physician on a structured pre-tested proforma.

Statistical analysis was performed using SPSS version15. Frequencies and percentages were computed to present the categorical variables like gender, patient's presenting complaint, dyslipidaemia, hypertension and Metabolic Syndrome; chi-square test was applied to compare the above mentioned categorical variables between diabetic and non-diabetic groups and Fisher's Exact test was applied according to the condition of Pearson's Chi-square test that if was less than 5 is true, whereas appropriate test of significance. Numeric response variables like age, duration of diabetes mellitus, systolic and diastolic blood pressures, fasting and random blood sugar levels and lipid variables were presented by Mean ± SD; Students t-test (unpaired) was applied to compare the means of these numeric response variables between diabetic and non-diabetic groups. Statistical significance was taken at $p<0.05$.

Results

A total of 100 patients (50 diabetics and 50 non-diabetics) were inducted in the study. Among diabetic patients, 31 (62%) were males and 19 (38%) were females while in non-diabetic group, 29 (58%) were males and 21 (42%) were females. Mean age of diabetic patients was 41.6 ± 6.04 years while mean age of non-diabetic patients was 41.3 ± 6.61 years. Statistically insignificant difference of gender distribution ($p=0.683$) and mean age ($p=0.850$) was observed in both groups.

Patients of diabetic group had history of diabetes with average duration of 7.22 ± 3.32 years. Twenty eight (56%) non-diabetic patients and 12 (24%) diabetic patients presented with fever. Cough was reported by 10 (20%) diabetics and 19 (38%) non diabetic patients. Common factors reported by the patients during the inquiry of presenting complaint are shown in Table 1.

Among diabetic patients, all 50 (100%) were observed with dyslipidaemia and 44 (88%) were hypertensive while among non-diabetic patients, 44 (88%) were observed with dyslipidaemia and 17 (34%) were hypertensive. This data reveals significantly high proportion of dyslipidaemia ($p=0.027$) and hypertensive patients ($p<0.001$) in diabetic group than non-diabetic group.

Out of 50 diabetic patients, 30 (60%) were of Metabolic Syndrome while among 50 non-diabetic patients, 14 (28%) were of Metabolic Syndrome. Significantly high proportion of Metabolic Syndrome is revealed by this data ($p=0.001$), in diabetic patients with an increased waist circumference than non-diabetic patients.

Comparison of gender between diabetic and non-diabetic groups in relation with Metabolic Syndrome is shown in Table 2. Among 50 diabetic patients, 31 (62%) were male patients out of which 20 (64.5%) were of Metabolic Syndrome and 11 (35.5%) were of non-Metabolic Syndrome while among 19 diabetic females, 10 (52.6%) were of Metabolic Syndrome while 9 (47.4%) were of non-Metabolic Syndrome. Difference of Metabolic Syndrome was not found to be statistically significant between diabetic males and females ($p=0.405$). In the group of 50 non diabetic patients, 29 (58%) were males out of which 11 (37.9%) were of Metabolic Syndrome and 18 (62.1%) were of non-Metabolic Syndrome while among 21 non-diabetic female patients, only 3 (14.3%) were of Metabolic Syndrome while 18 were of non-Metabolic Syndrome. Difference of Metabolic Syndrome between non-diabetic males and females was also not found to be statistically significant ($p=0.110$).

Comparison of haemodynamic response, blood sugar level and lipid profile between diabetic and non-diabetic groups is shown in Table-3. Mean systolic blood pressure was significantly higher in diabetic than non diabetic group ($p<0.001$). Average fasting blood sugar level in diabetic group was 137.9 ± 21.6 mg/dl and of non diabetic group was 89.4 ± 20.5 mg/dl. A similar pattern of an increased average level was observed when random blood sugar was taken 2 hours after a normal diet. Average total cholesterol level in diabetic group was 188.0 ± 19.1 mg/dl, which was significantly higher than the average total cholesterol 166.5 ± 16.1 mg/dl of non diabetic group. A similar pattern was ob-

served while comparing the average triglyceride level but significantly low average HDL level mg/dl was observed in diabetic group than non diabetic group (41.8 ± 8.10 vs. 46.7 ± 6.31, p<0.001), which reveals an association of diabetes mellitus with dyslipidaemia.

Discussion

The incidence of the metabolic syndrome is rising worldwide. This is partly due to a significant increase in the prevalence of obesity. For the principal finding of the study regarding the Metabolic Syndrome, criteria for the Metabolic Syndrome proposed by a WHO workgroup[16] based on waist-hip ratio>0.90 or body mass index > 30 kg/m2 is used.

In our study, 60% of diabetic patients were of Metabolic Syndrome while among non-diabetic patients, 28% had Metabolic Syndrome. This data reveals significantly high proportion of Metabolic Syndrome in diabetic patients with an increased waist circumference than non-diabetic patients (p=0.001). This finding supports the statement given in study hypothesis that there is high number of Metabolic Syndrome in diabetic patients with an increased waist circumference. These results are quite similar with the findings of Elabbassi WN[17] and Ilanne-Parikka P, et al.[18]. But contrary with that of Vanhala MJ[19].

A gender difference in Metabolic Syndrome prevalence rates can be observed in most ethnicities and countries. In American whites and Taiwan area, the Metabolic Syndrome was slightly more prevalent in men than in women[20], which is familiar to our findings but in American blacks, Mexican Americans, Iran, India, Oman, Korea and Kinmen women had higher prevalence of the Metabolic Syndrome than men[12,21-24]. The gender difference is probably due to the difference in the frequency of each Metabolic Syndrome component between men and women.

In a Finnish cohort[19] of 1209 men free from CVD, DM, or cancer and followed up for approximately 12 years, the Metabolic Syndrome was associated with a 1.5 to 2.5 fold increase in cardiovascular mortality, and a similar 1.5 to 2 fold increase in all cause mortality. In the Botnia Study, which included 4483 men and women free from chronic heart disease, the Metabolic Syndrome was associated with a 1.8 fold increase in the adjusted risk of cardiovascular mortality using the WHO definition[25]. In our study, significantly high proportion of hypertensive patients in diabetic group than non diabetic group (p<0.001) were found, mean systolic blood pressure (mmHg) was significantly higher in diabetic than non diabetic group (144.1 ± 17.1 vs. 121.2 ± 20.9, p<0.001). This reveals that hypertension is associated with hyperglycaemia. In the ARIC study done by Liese AD et al., a combination of hypertension (blood pressure>140/90 mmHg and/or the use of antihypertensive treatment) and dyslipidaemia (triglycerides > 2.26 mmol/l and/or HDL< 0.9 mmol/l in men and < 1.2 in women) was observed in 10% of the subjects[26].

The clinical importance of the Metabolic Syndrome is related to its putative impact on cardiovascular morbidity and mortality; in a Scandinavian study, the prevalence of CHD, MI, and stroke were approximately threefold higher in subjects with the Metabolic Syndrome than it was in those without the syndrome[27]. The following question arises: Do we need to call the clustering of risk factors a syndrome or should we only list the individual risk factors? The combination of obesity and hypertension or dyslipidaemia was the most common risk factor combination in subjects with diabetes. Average total cholesterol level in diabetic group was 188.0±19.1 mg/dl, which was significantly higher than the average total cholesterol 166.5±16.1 mg/dl of non diabetic group. A similar pattern was observed while comparing the average triglyceride level but significantly low average HDL level was observed in diabetic group than non diabetic group (41.8±8.10vs. 46.7±6.31, p<0.001), which reveals an association of diabetes with dyslipidaemia. The criteria for dyslipidaemia were more dependent on the presence of hypertriglyceridemia than of low HDL-cholesterol; this could present a problem in patients with type-2 DM, in whom elevated triglyceride levels

Table 1. Comparison of history of presenting complaints between diabetic and non diabetic groups

Patient's history	Diabetic(n = 50)	Non-Diabetic (n = 50)
Diabetes mellitus	50 (100%)	0 (0%)
Fever	12 (24%)	28 (56%)
Cough	10 (20%)	19 (38%)
Burning	10 (20%)	10 (20%)
Epigastric pain	4 (8%)	2 (4%)
Hepatitis C Virus	0 (0%)	2 (4%)
Abdominal pain	0 (0%)	1 (2%)
Vertigo	0 (0%)	1 (2%)
Diarrhoea	1 (2%)	1 (2%)

Table 2. Comparison of gender between diabetic and non diabetic groups in relation with Metabolic Syndrome

Group	Gender		p-value
	Male	Female	
Diabetic	**n=31**	**n=19**	
* Metabolic syndrome	20(64.5%)	10(52.6%)	0.405
* Non-metabolic syndrome	11(35.5%)	09(47.4%)	
Non-diabetic	**n=29**	**n=21**	
* Metabolic syndrome	11(37.9%)	03(14.3%)	0.110
* Non-metabolic syndrome	18(62.1%)	18(85.7%)	

Table 3. Comparison of haemodynamic response, blood sugar level and lipid profile between diabetic and non diabetic groups

Hemodynamic response, Blood sugar level & Lipid variables	Group		p-value
	Diabetic (n = 50)	Non-Diabetic (n = 50)	
Systolic blood pressure (mmHg)	144.1 ± 17.1	121.2 ± 20.9	0.001
Diastolic blood pressure (mmHg)	83.6 ± 12.2	75.1 ± 15.9	0.004
Fasting blood sugar (mg/dl)	137.9 ± 21.6	89.4 ± 20.5	<0.001
*Random blood sugar (mg/dl)	254.5 ± 72.9	139.8 ± 27.1	<0.001
Total cholesterol (mg/dl)	188.0 ± 19.1	166.5 ± 16.1	0.015
Triglyceride (mg/dl)	153.3 ± 16.7	145.9 ± 13.1	0.001
High density lipoprotein (mg/dl)	41.8 ± 8.10	46.7 ± 6.31	<0.001

Sample taken after 2 hours of normal diet.

may be secondary to hyperglycaemia[28]. Our study revealed significantly high proportion of dyslipidaemia in diabetic than non diabetic group (p=0.027).

The main justification for the type of intervention used in the high-risk subjects in this study is that it may prevent or postpone the onset of type-2 DM and the complications related to the disease. Patients with diabetes with or without symptoms have an increased prevalence of both macrovascular and microvascular complications at the time when diabetes is diagnosed. Many also have hypertension and an atherogenic serum lipid profile[29].

As mentioned earlier obesity plays a central role in causing Metabolic Syndrome, so the fundamental approach to this syndrome is weight reduction and increased physical activity. However, drug treatment could be appropriate for DM and CVD risk reduction[30]. It is possible to achieve primary prevention of type-2 DM by means of a non-pharmacologic intervention that can be implemented in a primary health care setting.

Limitation of this study is that a multivariate analysis would have addressed the effect of other contributory factors and weightage of the significant effect of diabetes with increased waist circumference leading towards Metabolic Syndrome. This analysis would help in the management strategies for ideal glycaemic control in the presence of risk factors of Metabolic Syndrome. Another limitation of this study is that it does not include the personal and dietary habits of the participants.

Conclusion

Our study highlights an important role of physical fitness, exercise and routine walking habit to control waist circumference, hyperglycaemia and hyperlipidaemia. We also conclude from this study that significantly high proportion of patients with Metabolic Syndrome in diabetic than non diabetic group with an increased waist circumference supports the statement given in study hypothesis as high number of Metabolic Syndrome in diabetic patients with an increased waist circumference.

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