FREQUENCY OF METABOLIC SYNDROME IN PATIENTS WITH TYPE-2 DIABETES

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Background: Diabetes, Hypertension, Obesity and Ischaemic Heart Disease have become a problem of public health magnitude with substantial economic burden both in the developed as well as the developing countries. Obesity is quite frequent in Type 2 diabetics and also plays a central role in causing Metabolic Syndrome (MetS). Metabolic Syndrome significantly increases the incidence of cardiovascular complications. This study was done to determine the frequency of MetS in our Type 2 diabetic patients as most of the components of MetS can be modified and identifying/managing these at an early stage might be of considerable help in reducing cardiovascular complications. **Methods:** This cross-sectional study was done in Medical 'B' and Medical 'A' wards of Ayub Teaching Hospital, Abbottabad from Nov, 08 to April, 09. Type 2 Diabetic patients aged above 40 years who gave informed consent were included in the study. Data was collected through a structured proforma.Frequency of Metabolic Syndrome was estimated according to the IDF consensus worldwide definition of the MetS. **Results:** Of the 100 patients enrolled in this study 56 were females and 44 were males with a mean age of 59.9 years. Out of these 100 participants seventy six (76%) were diagnosed to have metabolic syndrome. Of the 56 females, forty eight (85.71%) were having metabolic syndrome while twenty eight (63.63%) of the 44 male participants were having the syndrome. The difference was statistically significant ($p<0.05$). **Conclusion:** Frequency of MetS was found to be significantly high in this study with female preponderance. All the components, except Hypertension were more frequent in females. Diabetic patients with metabolic syndrome need more aggressive approach in management so as to decrease the incidence of cardiovascular complications.

Keywords: Metabolic Syndrome, Type 2 Diabetes Mellitus, Cardiovascular Complications

INTRODUCTION

Type 2 Diabetes Mellitus is increasing at an alarming rate especially in the developing countries[1] and is almost an epidemic now-a-days[2]. There is a high prevalence of long-term diabetic complications in our patients due to multiple factors (e.g. poor control, obesity etc.) responsible for substantial economic burden.[3] It is also established that there is a worldwide association between Type 2 Diabetes Mellitus , Obesity and Physical inactivity.[4] Obesity in turn plays a central role in causing Metabolic Syndrome[5] which has been defined as a constellation of variables that predicts premature coronary artery disease and type 2 diabetes mellitus and these are the principal causes of long-term morbidity, mortality as well as excess health care cost[6,7]. The syndrome is said to be present when three or more of the following are present according to the NCEP-ATP III definition:[8]

- Abdominal obesity (waist circumference >102 cm in men and >88 cm in women).
- Triglycerides (TGs) ≥1.7 mmol/l.
- HDL Cholesterol <1.03 mmol/l in men and <1.29 mmol/l in women.
- Systolic BP ≥130 mmHg and/or Diastolic BP ≥85 mmHg.
- Fasting Plasma Glucose ≥6.1 mmol/l.

Although the need to diagnose MetS in diabetes is controversial, we believe it is worth considering because diabetic patients frequently visit health-care providers. A diagnosis of MetS in them will necessitate a more aggressive approach in management thus improving their life-style and decreasing the incidence of cardiovascular complications.[9] The importance of Diabetes Mellitus and its association with MetS is evident from the WHO definition of MetS[10] which states:

- Diabetes (Fasting Plasma Glucose ≥7.0 mmol/l and/or 2-hour plasma glucose ≥11.1 mmol/l, or impaired glucose regulation (FPG 6.1–6.9 mmol/l and/or 2-hour plasma glucose 7.8–11.0 mmol/l and/or insulin resistance (below lowest quartile of glucose uptake in the euglycaemic clamp) and two or more of the following.
- Raised triglycerides (≥1.7 mmol/l) and/or low HDL Cholesterol (<0.9 mmol/l in men, <1.0 mmol/l in women).
- Central Obesity (waist to hip ratio >0.90 in men, >0.85 in women) and/or body mass index (BMI) >30 kg/m².
- Raised blood pressure (Systolic blood pressure ≥140 mmHg and/or Diastolic blood pressure ≥90 mmHg).
- Microalbuminuria (urinary albumin excretion ≥20 µg/min or albumin/creatinine ratio ≥30 mg/g)

Almost similar criteria are considered in the IDF consensus worldwide definition of the metabolic syndrome[11,12] which states:

Central Obesity as defined for Asian population (Waist Circumference ≥90 cm in men, ≥ 80 cm in women), together with 2 of the following:

- Blood Pressure (Systolic blood pressure ≥130 mmHg, Diastolic BP ≥85 mmHg) or treatment of previously diagnosed hypertension
- Fasting Plasma Glucose ≥5.6 mmol/l (≥100 mg/dl) or previously diagnosed type 2 diabetes
- HDL Cholesterol <1.03 mmol/l (<40 mg/dl) in men, <1.29 mmol/l (<50 mg/dl) in women
- Triglycerides ≥1.7 mmol/l (≥150 mg/dl)

It is clear from the definitions stated above of metabolic syndrome that almost all the variables of MetS are preventable/modifiable. Public awareness can be started from diabetic patients because of their frequent encounter with health-care providers and general public can then be targeted to have a good quality life and excess health-care cost saved by decreasing cardiovascular complications.

MATERIAL AND METHODS

This cross-sectional study was conducted at Ayub Teaching Hospital, Abbottabad in Medical 'B' and 'A' units. The study period was 06 months from 1st Nov 2008 to 30th April 2009. Non-probability convenience sampling technique was used and 100 type 2 diabetics of either gender aged ≥40 years completed the study. Informed consent was taken from all the patients. Already diagnosed cases of Hypothyroidism, Nephrotic syndrome and patients with renal failure were excluded .Specifically designed forms were used to collect the data. Samples for blood glucose, TGs and HDL Cholesterol were taken after an overnight fast. Sitting blood pressure was measured with mercury sphygmomanometer after 10 minutes of rest. Two readings were taken and the mean was recorded for data. Waist circumference was measured at the level of the mid point between the high point of the iliac crest and the last rib. Metabolic syndrome was diagnosed using the IDF consensus worldwide definition as described above. This definition of MetS is simple, more practical and uniformly agreed upon.

Data was analysed using SPSS Version 10. Descriptive statistics are presented as a percentage of the total no. of the participants. Cross tabulation was used to determine the relationship of different variables of the metabolic syndrome. Chi-square test was applied for determination of p-values, and $p<0.05$ was considered as significant.

RESULTS

A total of 100 known type 2 diabetics were enrolled in this study. Fifty-six (56%) were females and 44 (44%) were males. The mean age of the study participants was 59.9 years ranging from 41 to 80 years (Table-1). Out of 100 participants 76 (76%) were diagnosed to have metabolic syndrome by applying the IDF consensus worldwide definition of MetS (Table-2). Of the 56 females 48 (85.71%) were found to have MetS while 28 (63.63%) of the 44 male participants were having the syndrome. The results are shown in Table-3 along with age group of patients. By applying IDF consensus worldwide definition of metabolic syndrome the following results obtained:

Twelve (12%) participants fulfilled all 5 criteria for metabolic syndrome. Twenty-eight (28%) of all the participants had four criteria of metabolic syndrome. Three criteria were fulfilled by 36 (36%) of all the participants.

Of the 44 males, 4 (9.09%) had all 5 components of MetS, 8 (18.18%) had 4 criteria while 3 criteria were present in 16 (36.36%). Of the 56 females, 8 (14.28%) had all 5 criteria while 4 and 3 criteria of metabolic syndrome were met by 20 (35.71%) participants each (Table-4).

Among the patients having metabolic syndrome the facts and figures were as follows:

The total number was 76 (76%). Out of 76 participants having the syndrome males were 28 (36.84%) and females were 48 (63.15%). All the patients were known diabetics. Increased waist circumference was found in 56 (73.68%), 16 (28.57%) were males and 40 (71.43%) were females. Hypertension was seen in 48 (63.16%) participants. Among these 24 (50%) were males and 24 (50%) were females. Triglycerides were increased in 36 (47.37%) participants with 12 (33.33%) males and 24 (66.67%) females having raised TGs. Decreased HDL Cholesterol levels were found in 64 (84.21%) patients of metabolic syndrome. Out of these 20 (31.25%) were males and 44 (68.75%) were females (Table-5). A comparison of participants having metabolic syndrome with those without the syndrome is shown (Table-6).

Frequency of metabolic syndrome increased with age. It increased from 66.66% in the age group 41–49 to 81.81% in the age group ≥70 years. The most common component of the metabolic syndrome was low HDL Cholesterol. The most common component of the metabolic syndrome in males was Hypertension while in females it was low HDL Cholesterol. Obesity (increased waist circumference) was more common in females as compared to males.

Table-1: Age distribution of the participants

Age Group (years)	Male	Female	Total
40–49	9	18	27
50–59	13	23	36
60–69	14	12	26
≥70	8	3	11
Total	44	56	100

Table-2: Frequency of metabolic syndrome

Gender	Total (n=100)	MetS (n=76)	% with MetS
Male	44	28	36.84
Female	56	48	63.16

Table-3: Metabolic Syndrome in Different Age Groups (n=76)

Age Group (in years)	Male	Female	Total	Percentage
41–49	3	15	18	23.68
50–59	8	20	28	36.84
60–69	10	11	21	27.63
≥70	7	2	9	11.84
Total	28	48	76	100

Table-4: No of the patients fulfilling different criteria of metabolic syndrome among patients having the syndrome (n=76)

	5 Criteria		4 Criteria		3 Criteria	
	No	%	No	%	No	%
Men (n=28)	4	9.09	8	18.18	16	36.36
Women (n=48)	8	14.28	20	35.71	20	35.71
Total (n=76)	12	15.78	28	36.84	36	47.38

Table-5: Frequency of the components of the metabolic syndrome in patients diagnosed to have MetS (n=76)

	Total (n=76)		Male (n=28)		Female (n=48)		
	No	%	No	%	No	%	*p*
Type 2 Diabetes	76	100	28	36.84	48	63.16	>0.05
Increased Waist Circumference	56	73.6	16	28.57	40	71.43	<0.05
Hypertension	48	63.2	24	50	24	50	>0.05
Raised Triglycerides	36	47.4	12	33.33	24	66.67	>0.05
Low HDL-C	64	84.2	20	31.25	44	68.75	<0.05

Table-6: Comparison of participants having metabolic syndrome (n=76) with those without the syndrome (n=24)

	Metabolic Syndrome	Mean±SD	*p*
Waist Circumference (in cm)	Yes	101.26±16.36	0.012*
	No	82.25±5.91	
Systolic Blood Pressure (in mmHg)	Yes	150.33±27.53	0.000*
	No	123.54±18.73	
Diastolic Blood Pressure (in mmHg)	Yes	89.28±11.68	0.000*
	No	75.21±13.14	
Triglycerides (in mg/dl)	Yes	133.47±65.15	0.001*
	No	95.75±38.52	
High Density Lipoprotein (in mg/dl)	Yes	36.16±11.58	0.001*
	No	46.62±12.50	

*Statistically significant

DISCUSSION

The diagnosis of metabolic syndrome in patients might hold promise for better control of diabetes and enhanced prevention of cardiovascular complications. According to IDF consensus worldwide definition of the syndrome[11,12], it is said to be present when central obesity together with any 2 among hypertension, diabetes mellitus or raised fasting blood glucose, raised triglycerides or decreased HDL-C are present in an individual.

In this study 100 type 2 diabetics were studied for the presence of metabolic syndrome. The frequency of metabolic syndrome was 76% which is in accordance with other studies, i.e., prevalence of 70–80% among Caucasian type 2 diabetics[13] and 75.6% among Chinese population with type 2 diabetes mellitus[14] were estimated. In our study metabolic syndrome was found to be more common in female type 2 diabetics as compared to their male counterparts. Different studies showed quite varied effects of gender on the metabolic syndrome in different populations. In USA, metabolic syndrome is more prevalent in white males.[15] In American blacks, Mexicans Americans, Korea, Kinmen, Iran, India and Oman, women had higher prevalence of the syndrome than men.[16–19] Nigerian women also have higher percentage than men.[20]

Prevalence of metabolic syndrome tends to increase with age.[21] This study also showed similar trend with 66.66% in age group 40–49 and increasing to 81.81% in age group ≥70 years. The prevalence of different risk factors in patients of both sexes was looked at. As all of them were diabetics, comparison was made for the presence of abdominal obesity, hypertension, low HDL and high triglycerides levels. Low HDL was most frequent while hyper-triglyceridaemia was least frequent. Abdominal obesity was the second most prevalent factor. The combination of abdominal obesity and low HDL was also reported as the most common combination among Chinese type-2 diabetics with metabolic syndrome.[22] In Greece the most prevalent risk factor was abdominal obesity.[23]

WHO estimates the prevalence of obesity to 4.8% in less affluent countries, 17.1% in countries undergoing economic transition and 20% in the developed world.[24] In our study 56% of the participants were obese but the sample population was type-2 diabetics. This high incidence of obesity contributes to a very high frequency of metabolic syndrome in our patients, especially women. Physical inactivity and excess weight have been shown to be the main underlying contributors to the development of metabolic syndrome.[25] The goal of identifying metabolic risk factors is to prevent morbidity and mortality due to type 2 diabetes and cardiovascular disease. The role of family physicians is important as they are the first line of health care providers to encounter patients and to provide preventive measures besides taking steps to reverse metabolic syndrome in those who have a combination of risk factors.[26] Since physical inactivity and excessive weight gain are the main underlying contributors to the development of metabolic syndrome, getting more exercise and loosing weight can help reduce or prevent the complications associated with this condition. Most of the risk factors are preventable and identifying these at an early stage at screening clinics and managing them accordingly might be of significant help as done elsewhere.[27]

It is evident from this study that metabolic syndrome is quite prevalent in our type 2 diabetic patients like in other parts of the world. It is very important to diagnose it early to prevent the life

threatening cardiovascular complications. Counselling and education on life-style modification, exercise and diet are paramount for diabetics in particular and obese people in general to decrease the risks associated with the metabolic syndrome. The limitations of our study are in large part, related to the cross-sectional design of the study. The study is limited to reporting disease prevalence data and the incidence of disease occurrence in this population cannot be inferred from this study.

CONCLUSION

Frequency of MetS was found to be significantly high in this study with female preponderance. All the components, except Hypertension were more frequent in females. Diabetic patients with metabolic syndrome need more aggressive approach in management so as to decrease the incidence of cardiovascular complications.

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