Original Article

Frequency of the metabolic syndrome in adult type2 diabetics presenting to Pakistan Institute of Medical Sciences

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Abstract

Objective: To determine the frequency of metabolic syndrome in both genders, in a limited adult type 2 diabetic population presenting to Pakistan Institute of Medical Sciences, Islamabad.

Methods: This was a cross sectional study conducted in a tertiary care teaching hospital. During the six months of study period, 106 adult type2 diabetics were examined and evaluated for the presence of metabolic syndrome according to the ATP-III criteria. Asian standards for the waist circumference were used.

Results: Out of 106 patients, 91 (85.8%) had metabolic syndrome of whom 95% were females. Abdominal obesity was present in 91% females and 86% males. Low HDL levels were present in all females and 83% males. Seventy eight percent females and 63% males had elevated levels of triglycerides. Hypertension was present in 68% and 73% females and males respectively.

Conclusion: This study showed a very high prevalence of the metabolic syndrome in type2 diabetic population. Females were more affected than males in all respects (JPMA 57:235;2007).

Introduction

The association between diabetes, obesity and hyperlipidaemia is long known and has been termed "insulin resistance syndrome", syndrome"X" and metabolic syndrome by various researchers.[1] This syndrome is recognized as constellation of metabolic risk factors for the development of type2 diabetes mellitus and atherosclerotic cardiovascular disease (ASCVD).[2] In 2001, the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel-III or ATP-III) suggested a working definition for the metabolic syndrome that included abdominal obesity, atherogenic hyperlipidemia, high blood pressure and impaired glucose tolerance.[3] Taken individually, each component of the metabolic syndrome is a well established risk factor for the ASCVD. These factors act synergistically and increase the risk for ASCVD from two to three folds.[4]

With growing problem of obesity in the modern world, a high prevalence of metabolic syndrome is observed. Findings from the National Health and Nutrition Examination Survey (NHANES) in USA suggested an unadjusted and age adjusted prevalence of 21.8% and 23.7% among US adults respectively.[2] The age adjusted prevalence in an Indian urban population was reported as 24.9%.[5]

The prevalence is higher among diabetics than non-diabetics and is reported as 70-80% among Caucasian type 2 diabetics.[6,7] A study conducted in Indian urban population gives a prevalence of 76.3% among type-2 diabetics.[8] Prevalence of diabetes in Pakistan is high and studies suggest that more than 12% of Pakistani adults above 25 years of age have diabetes.[9] Rapid urbanization and acquisition of western life style have resulted in decreased physical activity and increased calorie intake; two of the major contributors towards the development of diabetes and metabolic syndrome.[3] The exact prevalence of metabolic syndrome in Pakistan is not known, though United States census department has given an estimate of approximately 25% among general population.[10]

The recent Adult Treatment Panel (ATP III) guidelines have called specific attention to the importance of targeting the cardiovascular risk factors of the metabolic syndrome as a method of risk reduction therapy. Since the presence of metabolic syndrome and diabetes together poses a greater risk for the development of ASCVD than either alone, it is important to know the prevalence and pattern of metabolic syndrome among diabetics. This is necessary for the effective prevention of ASCVD among this particularly high risk group. We conducted this cross sectional study to determine the frequency of metabolic syndrome in a limited adult type 2 diabetic population and its differences between the two sexes.

Methods

This cross sectional study was conducted at Pakistan Institute of Medical Sciences, Islamabad, which is the largest tertiary care hospital in the northern half of Pakistan. Majority of the patients come from upper Punjab, North Western Frontier Province and Kashmir, as well as the city and suburbs of Islamabad. The hospital has a diabetes clinic on outpatient basis for the routine follow-up and monitoring of these patients.

During the study period of six months from January to June 2005, we enrolled a total of 106 adult type2 diabetics above 20 years of age who presented to the diabetic clinic or were admitted to the medical ward for glycaemic control.

All type1 diabetics as well as young type2 diabetics (age <20 years) were also excluded from the study. Patients with renal failure, Cushing syndrome or with ascites due to any reason were excluded. Patients with secondary hypertension, hepato-biliary disease and hypothyroidism were excluded from the study after thorough clinical evaluation. For nephrotic syndrome as an exclusion criterion, massive proteinuria was also required. Patients taking lipid-altering drugs were also not included.

Specifically designed forms were used to collect the data. Informed consent was taken after fully explaining the procedure and objective of the study. Demographic and clinical data, including ischaemic heart disease (evidenced by history of angina pain, myocardial infarction or coronary artery surgery); family history of diabetes, ischaemic heart disease and hypertension were recorded.

World Health Organization (WHO) criteria were used for the diagnosis and classification of diabetes mellitus.[11] Samples for blood glucose and serum lipid profile were taken after an overnight fast. Samples were analyzed on the Selectra E Vitalab analyzer by enzymatic colorimetric method.

Sitting blood pressure was measured with mercury sphygmomanometer, using the patient's right arm and after 10 minutes of rest. Two readings were taken and the mean was used for analysis.[12] Waist circumference was measured at the level of the mid point between the high point of the iliac crest and last rib on the sides and the umbilicus anatomy, using a tape measure with the person lightly clothed.[13] A waist circumference of =88 cm (for females) or =102 cm (for males) constitutes central obesity in Caucasian populations.[3] The NCEP/ATP III criteria for abdominal obesity in a slams was used and metabolic syndrome was defined according to the cut-offs of waist circumferences > 90 cm in men and > 80 cm in women.[14]

Metabolic Syndrome was diagnosed using the ATP III criteria (Table 1).

Data was entered and analyzed by using SPSS version 11 software. Demographic indicators and different parameters for metabolic syndrome recorded at the time of enrollment were analyzed. Descriptive analysis was done and reported as mean, standard deviation and median for continuous variables and frequencies and percentages for categorical variables.

Results

During the study period, 106 known cases of type2 diabetes mellitus were enrolled. Of these 106, 91 (85.8%) were diagnosed to have metabolic syndromoe. Of the 64 female patients, 61 (95.3%) had the metabolic syndrome whereas 30 (71.4%) of 42 males fulfilled the criteria of the syndrome. This difference was statistically significant (p=0.001).

The mean (standard deviation) age of all the metabolic syndrome patients was 49.7 (11.1) years. Thirty (32.9%) patients were between the age group 41 to 50 years. The family history of diabetes, obesity and ischaemic heart disease were present in 47 (51.6%), 38 (41.8%) and 25 (27.5%) patients respectively. Only 16 (17.6%) patients were smokers.

The mean (standard deviation) duration of diagnosis of diabetes was 6.5 (5.7) years. Forty six (50.5%) patients had it for less than 5 years. Majority (74.7%) of patients were currently treated with oral hypoglycemic agents. In 42 (46.2%) patients all the five risk factors for the metabolic syndrome were present. However in 15 (16.5%) patients only 3 risk factors were present. The baseline characteristics are shown in Table 2.

The comparison of various risk factors for diabetic metabolic syndrome in both sexes is shown in Figure. Our result showed that abdominal obesity was present in 91% female and in 86% male patients. However all female and 83% males had low HDL levels. Seventy eight percent females and 63% males had elevated levels of triglycerides. Hypertension was present in 68% and 73% females and males respectively.

Discussion

We studied 106 patients with type-2 diabetes mellitus using the ATPIII criteria. The study estimated a prevalence of 85.8%, which is very high. Studies conducted in other parts of the world estimated a prevalence of 70-80% among Caucasian type-2 diabetics[6] and 75.6% among Chinese population with type-2 diabetes mellitus.[15] An Indian population based study using the Caucasian criteria for abdominal obesity, gave a prevalence of 76.3% among type2 diabetics.[8]

Different studies report quite varied effects of gender on the metabolic syndrome in different populations. In USA, metabolic syndrome is more prevalent in white males than in females.[16] In American blacks, Mexican Americans, Korea, Iran, India, Oman, and Kinmen women had higher prevalence of the metabolic syndrome than men.[17-20] We observed that metabolic syndrome was more common in females with type-2 diabetes mellitus as compared to their male counterparts (p-value 0.001). The higher percentage is also reported in Nigerian women with type-2 diabetes mellitus.[21] The reason may be a relatively sedentary lifestyle of women, in this part of the world, due to religious and social barriers.

Table 1. ATP III Criteria for the diagnosis of Metabolic Syndrome.

*	Abdominal obesity * (waist circumference): men ≥ 90 cm; women ≥ 80 cm.
*	Triglycerides ≥150 mg/dl
*	HDL cholesterol: men < 40 mg/dl; women < 50 mg/dl
*	Blood pressure ≥130/ >85 mmHg (or taking antihypertensive medicines)
*	Fasting glucose ≥110 mg/dl (or having diabetes mellitus).

Diagnosis of metabolic syndrome is made when 3 or more of the risk determinants shown above are present.

* Values modified for the Asian population.

Prevalence of the metabolic syndrome tends to increase with age.[21,22] However, we did not find a statistically significant difference in the ages of both groups.

Family history of hypertension, type-2 diabetes mellitus and obesity are recognized markers of genetic predisposition to the syndrome.[23] Our study supports this fact as more patients with the syndrome had a family history of obesity and diabetes in the first degree relatives as compared with those without the metabolic syndrome.

We further categorized our patients with metabolic syndrome into three groups according to the number of metabolic risk factors present. The majority of patients were those who had all the five risk factors followed by those having four and three respectively. This trend is almost similar to that found in the Nigerian diabetic population.[21]

Table 2. Baseline characteristics of all diabetic patients diagnosed to have metabolic syndrome (n = 91).

Baseline characteristics	Number	Percentage
Age (in years)		
Mean (Standard Deviation)	49.7 (11.1)	
Median	48.0	
Range (min - max)	30 - 72	
Age Categories		
Upto 40 years	25	27.5%
41 to 50 years	30	32.9%
51 to 60 years	21	23.1%
More than 60 years	15	16.5%
Sex		
Male	30	33.0%
Occupation		
Services	14	15.4%
House wife	57	62.6%
Retired	18	19.8%
Unemployed	2	2 2.2%
Smokers	16	17.6%
Family history of		
Diabetes	47	51.6%
Obesity	38	41.8%
IHD	25	27.5%
Hypertension	40	43.9%
Duration of diabetes (in years)		
Mean (Standard Deviation)	6.57 (5.7)	
Median	5.0	
Duration Categories		
Upto 5 years	46	50.5%
More than 5 years	45	49.5%
Current Treatment		
Diet control	2	2.2%
OHD	68	74.7%
Insulin	16	17.6%
Nil	5	5.5%
Presence of Risk Factors		
Three	15	16.5%
Four	34	37.4%
Five	42	46.2%

OHD = Oral hypoglycaemic drugs

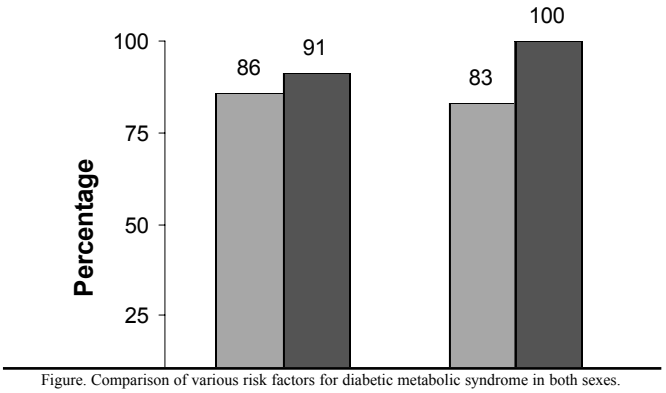

Figure. Comparison of various risk factors for diabetic metabolic syndrome in both sexes.

Finally, the prevalence of different risk factors in patients of both sexes with metabolic syndrome was studied. As all of the patients were diabetics, males and females were compared for the presence of abdominal obesity, hypertension, low HDL and high triglycerides levels. We found low HDL levels and abdominal obesity as the two most prevalent risk factors in both sexes. An interesting finding was that all of the females with metabolic syndrome had low HDL levels. The combination of abdominal obesity and dyslipidemia was also reported as the most common combination among Chinese type-2 diabetics with metabolic syndrome.[24] Abdominal obesity is reported as one of the most prevalent risk factor among patients with metabolic syndrome in Greece.[25]

In Kinmen, the most common abnormalities were high blood pressure in men and large waist circumference in women.[17] In the Iranian population, low HDL cholesterol was the most common metabolic abnormality in both sexes.[18] In western India, the prevalence of low HDL cholesterol was 90.2% in women and 54.9% in men.[19] Thus, it appears that low HDL cholesterol and large waist circumference are responsible for the high prevalence of metabolic syndrome in women in many populations.

Conclusion

Metabolic syndrome has been underestimated in our setup and not much importance is laid on its consequences. This limited observational study showed a very high prevalence of the metabolic syndrome in type2 diabetic population. There is a need to conduct a study involving a larger population and to make recommendations for the primary and secondary prevention of this syndrome.

References

1. Alexander C, Landsman P, Teutsch S, Haffner S. NCEP-defined metabolic syndrome, diabetes, and prevalence of coronary heart disease among NHANES III participants age 50 years and older. Diabetes 2003;52:1210-14.
2. Ford ES, Giles WH, Dietz WH. Prevalence of the metabolic syndrome among US adults: findings from the Third National Health and Nutrition Examination Survey. JAMA 2002;287:356-9.
3. Expert Panel on Detection, Evaluation and Treatment of High Blood Cholesterol in Adults: Executive Summary of the Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III). JAMA 2001;285:2486-97.
4. Bonora E, Kiechl S, Willeit J, Oberhollenzer F, Egger G, Bonadonna RC, et al. Carotid atherosclerosis and coronary heart disease in the metabolic syndrome: prospective data from the Bruneck study. Diabetes Care 2003;26: 1251-7.
5. Gupta R, Deedwania PC, Gupta A, Rastogi S, Panwar RB, Kothari K. Prevalence of metabolic syndrome in an Indian urban population. Int J Cardiol 2004;97:257-61.
6. Abdul-Rahim HF, Husseini A, Bjertness E, Giacaman R, Gordon NH, Jervell J. The metabolic syndrome in the West Bank population: an urban-rural comparison. Diabetes Care 2001;24:275-9.
7. Balkau B, Charles MA, Drivsholm T, Borch-Johnsen K, Wareham N, Yudkin JS, et al. Frequency of WHO-defined metabolic syndrome in European cohort and an alternative definition of an insulin resistance syndrome. Diabetes Metab 2002;28:364-76.
8. Agrawal V, Bansal M, Mehrotra R, Hansa G, Kasliwal RR. Prevalence of Metabolic Syndrome and its Individual Components in an Asymptomatic Urban North Indian Population. Indian Heart J 2003; 55: http://indianheartjournal.com/SeptOct03/abstract/html/190_prevalence_of_metabolic_syndrome.htm Accessed 10 September 2005.
9. Shera AS, Rafique G, Khwaja KI, Ara J, Baqai S, King H. Pakistan National Diabetes Survey: Prevalence of glucose intolerance and associated factors in Shikarpur, Sindh Province. Diabetic Medicine 1995;12:1116-21.
10. US Census Bureau, Population Estimates, 2004. Available from http://www.wrongdiagnosis.com/m/metabolic_syndrome/stats-country.htm. Accessed 10 September 2005.
11. World Health Organization. Definition, diagnosis and classification of diabetes mellitus and its complications: Report of a WHO consultation, part I: Diagnosis and classification of diabetes mellitus. Geneva, Switzerland; 1999.
12. Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo JL jr, et al. 7th report of the Joint National committee on prevention, detection, evaluation and treatment of high blood pressure. JAMA 2003;289:2560-72.
13. Chuang SY, Chen CH, Chou P. Prevalence of metabolic syndrome in a large health check-up population in Taiwan. J Chin Med Assoc 2004;67:611-20.
14. Inoue S, P Zimmet. The Asia-Pacific perspective: redefining obesity and its treatment. Sydney: Health Communications Australia Pty. 2000: pp 17-20.
15. Bruno G, Merletti F, Biggeri A, Bargero G, Ferrero S, Runzo C, et al: Metabolic syndrome as a predictor of all-cause and cardiovascular mortality in type 2 diabetes: the Casale Monferrato Study. Diabetes Care 2004;27: 2689-94.
16. Park YW, Zhu S, Palaniappan L, Heshka S, Carnethon MR, Heymsfield SB. The metabolic syndrome: prevalence and associated risk factor findings in the US population from the Third National Health and Nutrition Examination Survey, 1988-1994. Arch Intern Med 2003;163:427-36.
17. Chuang SY, Chen CH, Tsai ST, Chou P. Clinical identification of the metabolic syndrome in Kinmen. Acta Cardiol Sin 2002;18:16-23.
18. Azizi F, Salehi P, Etemadi A, Zahedi-Asl S. Prevalence of metabolic syndrome in an urban population: Tehran Lipid and Glucose Study. Diabetes Res Clin Pract 2003;61:29-37.
19. Gupta A, Gupta R, Sarna M, Rastogi S, Gupta VP, Kothari K. Prevalence of diabetes, impaired fasting glucose and insulin resistance syndrome in an urban Indian population. Diabetes Res Clin Pract 2003;61:69-76.
20. Park JS, Park HD, Yun JW, Jung CH, Lee WY, Kim SW. Prevalence of the metabolic syndrome as defined by NCEP-ATP III among the urban Korean population. Korean J Med 2002;63:290-8.
21. Isezuo SA, Ezunu E. Demographic and clinical correlates of metabolic syndrome in Native African type-2 diabetic patients. J Natl Med Assoc 2005; 97:557-63.
22. Thomas GN, Ho SY, Janus ED, Lam KS, Hedley AJ, Lam TH. The US National Cholesterol Education Programme Adult Treatment Panel III (NCEP ATP III) prevalence of the metabolic syndrome in a Chinese population. Diabetes Res Clin Pract 2005;67:251-7.
23. Hunt KJ, Heiss G, Sholinsky PD, Province MA. Family history of metabolic disorders and the multiple metabolic syndromes: The NALBI family heart study. Genet Epidemiol 2000;19:395-409.
24. Lee YJ, Tsai JC: ACE gene insertion/deletion polymorphism associated with 1998 World Health Organization definition of metabolic syndrome in Chinese type 2 diabetic patients. Diabetes Care 2002;25:1002-08.
25. Athyros VG, Bouloukos VI, Pehlivanidis AN, Dionysopoulou SG, Symeonidis AN, et al. The prevalence of the metabolic syndrome in Greece: the MetS-Greece Multicentre Study. Diabetes Obes Metab 2005;7:397-405.