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Clustering of metabolic factors among the patients with essential hypertension

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Abstract

The prevalence of metabolic syndrome was determined in clinic–based 1,517 hypertensive patients. All traits were present in 1.1% men and 12.8% women. Combination of different three traits were present as follows; hypertension with high triglyceride and low HDL (men 29.4% vs. women 51.8%), hypertension with high blood glucose and low HDL (men 13.5% vs. women 29.8%), hypertension with high glucose and high triglyceride (men 18.1% vs. women 18.1%), hypertension with high blood glucose and large waist (men 2.7% vs. women 25.7%), hypertension with high triglyceride and large waist (men 3.4% vs. women 39.3%) and hypertension with low HDL and large waist (men 2.5% vs. women 70.6%). This study shows that the metabolic syndrome is highly prevalent among hypertensive patients especially women.

Introduction

The metabolic syndrome is a constellation of cardiovascular risk factors centered around obesity, abnormal glucose metabolism, hypertension and dyslipidemia. These risk factors tend to cluster together in subjects, and when they do, substantially increase the risk of the development of cardiovascular disease[1,2].

The metabolic syndrome portends the onset of diabetes[3] and is associated with intermediate risk for the development of cardiovascular disease relative to diabetes in population-based studies[4-6].

The definition of metabolic syndrome proposed by National Cholesterol Education Program - Adult Treatment Panel III (NCEP-ATP III)[7] was used in this study. Metabolic syndrome in Asia is more prevalent than any part of the world[8]. Studies in Bangladeshi emigrants have reported that they have a higher prevalence of metabolic syndrome or its traits than Europeans[6, 9].

High BP is considered one of the key features of the metabolic syndrome[7,10], and the recent clinical guidelines for the management of hypertension underscore the importance of identifying hypertensive patients with the metabolic syndrome as a group at high risk for the development of cardiovascular disease[11].

Hypertension is one of the most common cardiovascular risk factors among urban Bangladeshi[8]. Other cardiovascular risk factors conglomerate around the core of hypertension, which ultimately manifest into a coronary heart disease[12]. This is important because it is largely preventable by lifestyle measures. However, the magnitude of the metabolic syndrome in Bangladeshi population is not precisely known. We, therefore, investigated to see the prevalence of metabolic syndrome and co-existence of cardiovascular risk factors in hypertensive patients.

Materials and Methods

This study was carried out in the Hypertension Clinic of Department of Cardiology, Bangabandhu Sheikh Mujib Medical University (BSMMU) Dhaka, from April 2000 to March 2003. Total 1,517 consecutive patients (811 men, 706 women) were recruited. Patients with high records of blood pressure or history of hypertension with medication from out-patient or in-patient departments of the university hospital were being referred to hypertension clinic for evaluation and management. Informed consents were obtained from all patients. The ethics committee of the University approved this study. Clinical history, dietary habit, treatment

Table I: Mean and standard deviation of quantitative variables in patients with hypertension*

	Men (n=811)	Women (n=706)
Age, years	49.9 ± 13.3	46.2 ± 11.8
Education, years	10.7 ± 4.7	6.9 ± 5.1
Dietary frequency for 3 days		
Vegetables	5.6 ± 1.0	5.6 ± 1.1
Fruits	1.8 ± 1.3	1.7 ± 1.3
Height, cm	162.1 ± 7.5	151.3 ± 6.7
Weight, kg	65 ± 10.6	59.4 ± 11.0
Body mass index, kg/m^2	24.7 ± 3.6	25.9 ± 4.4
Waist circumference, cm	87.3 ± 9.1	86.7 ± 10.5
Pulse, beats/minute	80.2 ± 11.0	82.5 ± 11.1
Systolic blood pressure, mmHg	156.9 ± 24.4	158.0 ± 24.2
Diastolic blood pressure, mmHg	96.8 ± 13.2	97.4 ± 12.3
Plasma glucose, mmol/L	5.8 ± 1.9	5.9 ± 2.3
Total cholesterol, mg/dL	184.8 ± 39.4	189.7 ± 41.8
HDL cholesterol, mg/dL	40.4 ± 8.1	41.6 ± 10.9
LDL cholesterol, mg/dL	107.2 ± 37.7	113.7 ± 40.2
Triglycerides, mg/dL	193.1 ± 120.9	180.2 ± 93.5

*BP≥140/90 mmHg or medication for high blood pressure; SD=standard deviation, n=number; Data are mean ± SD

regarding diabetes and hypertension, and anthropometric measurements (height, weight and waist circumference) were recorded. Patients were advised not to take caffeine and avoid smoking one hour before the blood pressure measurement. Patients were advised to take rest for 5 min then blood pressure was measured in sitting posture with arm at the level of the heart. Systolic pressure was noted at appearance of Korotkoff sound (Korotkoff Phase – I at nearest 2 mmHg) and diastolic pressure was noted as the average of muffling of sound and disappearance of sound (Korotkoff Phase – IV-V). Pressure was recorded in both arms and a second reading was taken after three min and average of the two measurements was recorded. In this study hypertension was defined as systolic blood pressure 140 mmHg or diastolic blood pressure 90 mmHg or more or use of antihypertensive drugs. All new patients had a 'wash out' time for 7 days and follow up for all new and old patients (taking drugs) were at 7 days, 30 days and 90 days and thereafter as required.

Anthropometrics measurements included waist circumference in cm, height in cm and weight in kg. Waist circumference was measured in standing position with feet together and arms at the side and abdomen relaxed. A tape was placed around the waist at the level of umbilicus midway between the bottom of the rib and the top of the hipbone. Tape was placed firmly with no cloths in between.

Patients were asked to undergo a biochemical investigation in the university laboratory on the following day after overnight (8-12 hours) fasting. Venous whole blood samples were collected for measuring glucose, total cholesterol, HDL-cholesterol, LDL-cholesterol and triglycerides. Serum glucose levels were determined using the glucose oxidase method and lipid profile by enzymatic methods. Measurements were performed in the Department of Biochemistry by the auto analyzer (Synchron CX5 clinical system of Beckman and Coulter Company).

Statistical analysis: Data were analyzed using SAS (Statistical analysis system, Cary, N.C.). Mean and standard deviations (SD) were calculated for the quantitative variables. Percentage and standard error (SE) were calculated for frequency variables. A p value ≤ 0.05 considered statistically significant.

Results

The mean ± SD age of the patients was 48.2 ± 12.8 years. The patient characteristics and mean levels of variables measured or inquired are summarized in Table I. There was no significant difference in patient characteristics between men and women except tobacco consumption, which is higher in men (Table II). Alcohol consumption was almost nil in our population. The age-specific prevalence of individual trait of metabolic syndrome is shown in Table III. Larger waist circumference and high blood glucose level were more frequently observed in 40-70 years of age where as no difference was observed in any age group regarding HDL cholesterol and triglycerides. Among hypertensive patients 31.7% had hyperglycemia, 38.7% high waist circumference, 68.8% low HDL cholesterol

Table II: Prevalence of categorical variables in patients with hypertension*

Variables	Men n=811	Women n=706
Sedentary occupation	60.2%	64.5%
Smoker		
Previous	30.9%	0.3%
Current	21.1%	0.9%
Chewing tobacco users		
Previous	6.0%	5.2%
Current	9.9%	21.7%
Alcohol drinker	1.5%	0.0%
Medication for		
Hypertension	66.6%	70.8%
Diabetes mellitus	12.9%	13.2%

*BP≥140/90 mmHg or medication for high blood pressure; n=number

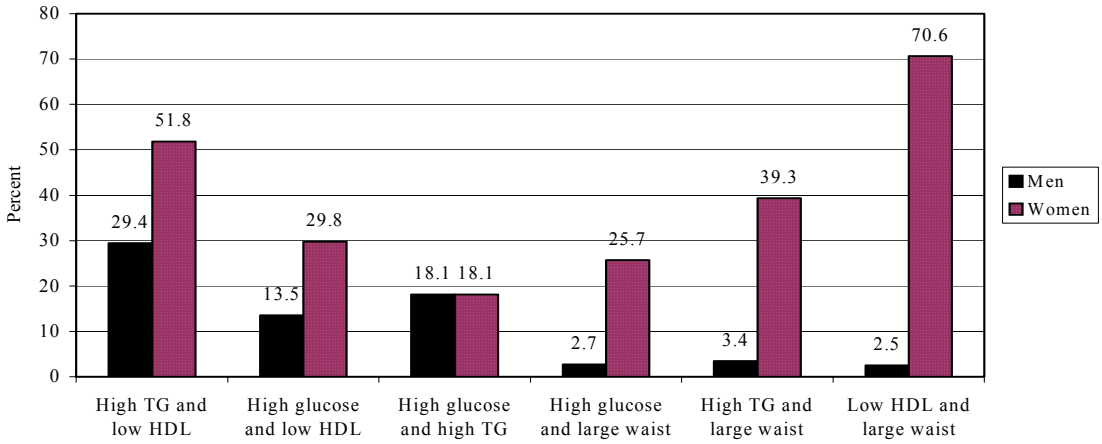

Figure 1: Combination of three traits of metabolic syndrome

Table III: Prevalence of metabolic factors in patients with hypertension*

Age (Years)	n	High waist circumference (>102 in men or >88 in women)	Low HDL cholesterol (<40 mg/dL in men, <50 in women)	High triglycerides (>150 mg/dL)	Hyperglycemia (>6.1 mmol/L or medication)
Men					
20-29	34	0.0%	61.8%	67.7%	17.7%
30-39	82	3.7%	51.2%	59.8%	19.5%
40-49	176	6.3%	45.5%	57.9%	27.3%
50-59	173	5.9%	48.6%	58.0%	32.4%
60-69	104	6.9%	46.2%	53.9%	44.2%
70-79	68	2.9%	47.1%	38.2%	35.3%
Women					
20-29	22	63.6%	95.5%	50.0%	18.2%
30-39	134	78.9%	90.3%	45.5%	23.9%
40-49	178	82.9%	94.4%	58.4%	36.9%
50-59	123	78.3%	91.1%	52.9%	33.3%
60-69	73	72.2%	93.2%	61.6%	45.2%
70-79	24	45.8%	91.7%	58.3%	25.0%

* blood pressure ≥140/90 mmHg or medication; n=number

and 55.3% high triglycerides. As per definition of NCEP-ATP-III, metabolic syndrome had been detected in 89.6% of male, 43.1% of female and 64% of the total population. All traits were present in 1.1% men and 12.8% women. Combination of three traits of metabolic syndrome is presented in Figure 1.

Discussion

Cardiovascular mortality is increased in subjects with the metabolic syndrome[6]. We used the definition of metabolic syndrome proposed by the NCEP-ATP III[7]. In this study it is observed that one third of men and three quarter of women are having metabolic syndrome depending on the component considered. This is very high as compared to another study conducted in free living sample of rural Bangladeshi women in which the prevalence was less than three percent.[13] It is also higher than that was found in Asians (14% men and 19% women)[14], native Americans (10% men and 6% women)[15] and Europeans (10% men and 13% women).[6] The direct comparison of this study with others is difficult as all the subjects in this study were hypertensive and most of them were urban dwellers.

As we have taken the hypertensive patients so hypertension was the common component in all subjects. Our study has similar result shown by Greenlund et al.[15] where it was 76.5%. In comparison to Europeans, South Asians have higher prevalence of hypertension, diabetes mellitus and dyslipidemia. Their mean waist to hip ratio (WHR) was also significantly higher indicating higher central obesity and insulin resistance[16]. Hence, this study provides evidence that the metabolic syndrome may be useful as an

integrating index of the overall burden imposed by metabolic factors on the cardiovascular system in hypertensive patients.

The prevalence of metabolic syndrome is more common in women, which increased with age. Gender difference in the prevalence of the metabolic syndrome with age may be related to the higher prevalence of abdominal obesity and prominence of weight gain associated with increase of age in women.

Tobacco consumption was found to be a significant independent risk factor for metabolic syndrome in both men and women. Furthermore tobacco is known to impair insulin action and may lead to insulin resistance[17]. Smoker has been shown to be hyperinsulinemic[18]. Cigarette smoking may also induce an increase abdominal obesity[19]. As well as causation of hypertension by increasing sympathetic activity and it may elevate triglyceride and lower HDL[20]. The cluster of metabolic syndrome has been shown 6 fold higher in smoker than non-smoker[21].

Mild to moderate alcohol consumption has been found to have beneficial effect on HDL and blood pressure[21,22]. In this study alcohol consumption is almost absent. This is one of the causes for higher prevalence of metabolic syndrome in this group of patients. In general the mean HDL level in Bangladeshi people is low[23].

Hyperglycemia is much common (32% vs. 8%[26]) in this study. 38.7% had higher waist circumference, 55.3% had higher triglyceride (187 vs. 130 mg/dL) and 68.8% had decreased HDL (41 vs. 39 mg/dL), which is much higher than normal population. These data showed that the clustering of metabolic factors is common in hypertensive patients.

South Asians (Bangladeshi, Indian and Pakistani) living in urban societies have a higher prevalence of many of the complications of obesity than other ethnic groups. These complications are associated with abdominal fat distribution that is markedly higher for a given level of BMI than in Europeans[24]. These findings lead to assumption that there may be a genetic susceptibility for development of metabolic syndrome in Bangladeshi people. Unhealthy lifestyles such as low level of physical activity, tobacco consumption, fatty, salty and sugary diet are the environmental factors.

In conclusion, hypertensive patients with the metabolic syndrome are at increased risk of coronary and cerebrovascular disease and require a more vigorous non-drug and pharmacologic preventive approach.

References

1. Wilson PW, Grundy SM. The metabolic syndrome: Practical guide to origins and treatment: Part I. Circulation 2003; 108: 1422-24.
2. Wilson PW, Grundy SM. The metabolic syndrome: A practical guide to origins and treatment: Part II. Circulation 2003; 108: 1537-40.
3. Sattar N, Gaw A, Scherbakova O, Ford I, O'Reilly DJ, Haffner SM, Isles C, Macfarlane PW, Packard CJ, Cobbe SM, Shepherd J . Metabolic syndrome with and without C- reactive protein as a predictor of coronary heart disease and diabetes in the West of Scotland Coronary Prevention Study. Circulation 2003; 108: 414-19.
4. Alexander CM, Landsman PB, Teutsch SM, Haffner SM. 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.
5. Eckel RH, Grundy SM, Zimmet PZ. The metabolic syndrome. Lancet 2005; 365: 1415-28.
6. Isomaa B, Almgren P, Tuomi T, Forsén B, Lahti K, Nissén M, Taskinen M, Groop L. Cardiovascular morbidity and mortality associated with the metabolic syndrome. Diabetes Care 2001; 24: 683-89.
7. National Heart Lung and Blood Institute. 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.
8. McKeigue PM, Shah B, Marmot MG. Relation of central obesity and insulin resistance with high diabetes prevalence and cardiovascular risk in South Asians. Lancet 1991; 337: 382-86.
9. Samuelsson O, Wilhelmsen L, Elmfeldt D. Predictors of cardiovascular morbidity in treated hypertension: Results from the primary preventive trial in Göteborg, Sweden. J Hypertens. 1985; 3: 167-76.
10. Zavaroni I, Mazza S, Dall'Aglio E, Gasparini P, Passeri M, Reaven GM. Prevalence of hyperinsulinemia in patients with high blood pressure. J Intern Med. 1992; 231: 235-40.
11. Guidelines Committee. 2003 European Society of Hypertension, European Society of Cardiology guidelines for the management of arterial hypertension. J Hypertens. 2003; 21: 1011-53.
12. Reaven GM: Banting Lecture 1988. Role of insulin resistance in human disease. Diabetes 1988: 37: 1595-607.
13. Zaman MM, Choudhury SR, Ahmad J, Noman SM, Islam SM, Parvin K. Prevalence of metabolic syndrome in a rural population of Bangladesh. Diabetes Care 2006; 29: 1456-57.
14. Park HS, Oh SW, Cho S, Choi WH, Kim YS. The metabolic syndrome and associated life style factors among South Korean adults. Int J Epidemiol. 2004; 33: 328-36.

15. Greenlund KJ, Valdej R, Casper ML, Rith-Najarian S, Croft JB. Prevalence and correlates of the insulin resistance syndrome among native Americans. Diabetes Care 1999; 22: 441-47.

16. McKiegue PM, Pierpoint T, Ferrie JE, Maromot MG. Relationship of glucose intolerance and hyperinsulinemia to body fat pattern in South Asians and Europeans. Diabetologia 1992; 35: 785-91.

17. Kong C, Nimmo L, Elatrozy T. Smoking associated with increased hepatic lipase activity, insulin resistance, dyslipidemia and early atherosclerosis in type 2 diabetes. Atherosclerosis 2001; 156: 373-78.

18. Tahtinen TM, Vanhala MJ, Oikarinen JA, Keinanen-Kiukaanniemi SM. Effect of smoking on the prevalence of insulin resistance-associated cardiovascular risk factors among Finnish men in military service. J Cardiovasc Risk 1998; 5: 319-23.

19. Shimokata H, Muller DC, Anders R. Studies in the distribution of body fat. III. Effects of cigarette smoking. JAMA 1989; 261: 1169-73.

20. Bleich S, Bleich K. Moderate alcohol consumption and the risk of cardiovascular disease. Am J Clin Nutr. 2002; 75: 948.

21. Lamon-Fava S. High-density lipoproteins: Effects of alcohol, estrogen, and phytoestrogens. Nutr Rev. 2002; 60: 1-7.

22. Gillman MW, Cook NR, Evans DA, Rosner B, Hennekens CH. Relationship of alcohol intake with blood pressure in young adults. Hypertension 1995; 25: 1106-10.

23. Zaman MM, Choudhury SR, Ahmed J, Yosiike N, Noman SM, Islam MS, Parvin K. Plasma lipids in rural population of Bangladesh. Eur J Cardiovasc Prev Rehabil. 2006; 13: 444-48.