

Research Article

The metabolic syndrome among hypertensive patients: a cross-sectional study

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Received: 02 July 2015

Revised: 03 July 2015

Accepted: 19 July 2015

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ABSTRACT

Background: Hypertension is the key component of the metabolic syndrome (MS). Insulin resistance is regarded as the underlying pathophysiological basis of the clustering metabolic abnormalities associated with the MS. Increased cardiovascular risk in hypertensive patients might be partially attribute to metabolic disturbance. This study was undertaken to determine the prevalence of the metabolic syndrome and its individual components among hypertensive patients using the National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III) criteria in a tertiary healthcare centre in Ahmedabad.

Methods: This was a cross-sectional observational study in a sample of 200 patients with high blood pressure (aged ≥ 20 years) Informed written consent was taken. The following measurements were taken: blood pressure; Body Mass Index (BMI); waist and hip circumferences; plasma glucose, lipid levels; High blood pressure criterion: average systolic blood pressure ≥ 140 mmHg and/or diastolic blood pressure ≥ 90 mmHg; Metabolic Syndrome diagnosis according to NCEP ATP III criterion.

Results: Prevalence of metabolic syndrome was 44.5% (n=89) inpatients of hypertension. The prevalence of metabolic syndrome was higher in women 62.92% (n=56) as compared to men 37.08% (n=33). The most common abnormality found was obesity (high waist circumference), seen in 91.01% (n=81), followed by low HDL-C in 40.5% (n=72) an abnormal triglyceride level in 32% (n=69) and abnormal FBS 34% (n=65). Amongst all females 92.4% (n=98) had an abnormal HDL-C levels followed by an abnormal waist circumference in 52.38% (n=55). Incidence of abnormal FBS and TG in females were 30.5% (n=33) and 32.4% (n=35) respectively.

Conclusions: The prevalence of the metabolic syndrome is high among newly diagnosed hypertensive patients. This underscores the importance of routine screening of hypertensive patients for other cardiovascular risk factors.

Keywords: Metabolic syndrome, Hypertension, Risk factors

INTRODUCTION

A clustering of cardiovascular risk factors that appeared in certain patients was identified as syndrome X by Reaven in 1988. The risk factors identified by Reaven included glucose intolerance, hypertension, elevated triglyceride and low high density lipoprotein cholesterol.¹

In 1998 the WHO proposed a definition for metabolic syndrome that included the presence of hypertension, dyslipidemia, glucose intolerance and microalbuminuria.² The National Cholesterol Educational Program's Adult Treatment Panel III (NCEP ATP III) proposed a new definition which utilised components that were typically measured in these patients (Blood pressure, lipids and glucose) or could be easily measured in clinical practice (waist circumference).³

There is alarmingly high prevalence of diabetes and hypertension in the Indian population which has been attributed to metabolic syndrome. Several studies have shown a high incidence of this syndrome in Indians compared to Western population. ATP III considered the obesity epidemic is mainly responsible for the rising prevalence of metabolic syndrome. Obesity contributes to hypertension, high serum cholesterol, low HDL, and hyperglycaemia and it is otherwise associated with high cardiovascular disease risk.^{4,5}

Women tend to have fewer cardiovascular events, the population-attributable risk for hypertension is higher for women than men due to their longer life expectancy and the rise in the incidence of hypertension with age.⁶ Advancing age affects all levels of pathogenesis which likely explains why prevalence MS increase with age.⁷

Criteria for diagnosing metabolic syndrome (three or more of the risk factors) according to the National Cholesterol Educational Program's ATP III criteria⁵

Risk factor	Defining level
(1) Abdominal obesity	Waist circumference
Men	>102 cm (40 inches)
Women	> 88 cm (35 inches)
(2) TG	≥ 150 mg/dl
(3) HDL-C	
Men	<40 mg/dl
Women	<50 mg/dl
(4) Blood pressure	>130/>85 mmHg
(5) Fasting glucose	≥110 mg/dl

When hypertension and other metabolic risk factors co-exist in an individual, they potentiate one another leading to a synergism that increases the total cardiovascular disease (CVD) risk well above that which results from the sum of the individual risk factors.⁶

The aim of this study was to determine the prevalence of metabolic syndrome among patients with essential hypertension.

METHODS

We carried out an observational and non-interventional study in 200 patients having essential hypertension attending the medicine outdoor patients department of the tertiary care centre. The study subjects were examined and their laboratory investigations carried out in fasting state.

Inclusion criteria

The study included patients attending the medicine outdoor patient department having essential hypertension i.e. BP >140/90 or on antihypertensive treatment between the age group of 25-70 years.

Exclusion criteria

- (1) Age >70 years.
- (2) Age <25 years.
- (3) Patients on medications like steroid treatment for any cause, decongestants, appetite suppressants, cyclosporine, tricyclic antidepressants, mono aminoxidase inhibitors, erythropoietin, non-steroidal anti-inflammatory agents, cocaine.
- (4) Renal failure.
- (5) Obstructive sleep apnea.
- (6) Hypothyroidism, hyperthyroidism, hypercalcemia, acromegaly.
- (7) Preeclampsia/eclampsia.

Blood pressure was measured in each arm using standard adult arm cuff of a mercury sphygmomanometer with the subject's arm supported and at least 10 minutes after rest in sitting position. The mean of three measurements of the systolic and diastolic blood pressure was used.

Where there was a difference in the BP between the two arms, the higher value was adopted. Measurement of height was done to the nearest 0.01metres using a stadiometer with the subject unshod, feet together, arms by the sides and in an erect posture on the stadiometer foot-rest. Waist Circumference (WC) was measured in a horizontal plane midway between the inferior margin of the ribs and the superior border of the iliac crest with the subject standing erect, arms by the sides but away from the trunk, abdomen bare and breathing normally. A non-stretchable tape measure graduated in centimetres was used for the measurement. The average of two measurements taken after inspiration and expiration at nearest half centimetre was calculated. Blood glucose was measured using GOD/POD method (glucose oxidase to peroxides) method. Lipid profile was measured using an auto analyzer and lipoprotein fractions were measured enzymatically.

Statistical Analysis

Descriptive statistics, Chi-squared test was used to examine the data. All continuous variables were reported as mean, Standard Deviation (SD) and range throughout the study. Differences were considered significant at $P \leq 0.05$.

RESULTS

Prevalence of metabolic syndrome was 44.5% i.e. out of 200 patients enrolled 89 patients had metabolic syndrome. The prevalence of metabolic syndrome was

higher in women 62.92% (n=56) as compared to men 37.08% (n=33).

The age of the study subjects ranged from 25 to 70 years with mean (SD) of 51.285 (10.163) years. When the various clinical and metabolic parameters were compared between the cases with and without metabolic syndrome significant difference was found with variables of BMI, waist circumference, hip circumference, FBS, triglycerides (TG), HDL-C and TG/HDL-C ratio. These are variables which are deranged in metabolic syndrome.

Table 1: Frequency of metabolic syndrome according to Adult Treatment Panel III criteria.

Diagnosis by ATP III criteria	Males N=95		Females N=105		Total N=200	
	No.	%	No.	%	No.	%
Metabolic syndrome	33	34.73	56	53.33	89	44.5
No metabolic syndrome	62	65.27	49	46.66	111	55.5

Table 2: Frequency of risk factors according to Adult Treatment Panel III criteria in patients with and without MS.

ATP III criteria	Patients with metabolic syndrome N=89		Patients with no metabolic syndrome N=111		Total N=200		Chi-test	Significance
	No.	%	No.	%	No.	%		
Obesity (high W/C)	81	91.01	12	10.81	93	46.5	1.29812E-29	Significant
FBS>110	65	73.03	3	2.70	68	34	1.72291E-25	Significant
High TG	69	77.52	9	8.10	78	38	1.479E-23	Significant
Low HDL-C	72	80.89	27	24.32	99	49.5	1.82497E-15	Significant

Amongst all females 92.4% (n=98) had an abnormal HDL-C levels followed by an abnormal waist circumference in 52.38% (n=55). Incidence of abnormal FBS and TG in females were 30.5% (n=33) and 32.4% (n=35) respectively.

Amongst all males 51.57% (n=49) had abnormal HDL-C levels followed by an abnormal TG in 35.78% (n=34). The FBS and waist circumference were abnormal in 33.68% (n=32) and 35.78% (n= 34) respectively.

DISCUSSION

Prevalence of metabolic syndrome is 44.5% i.e. out of 200 patients enrolled 89 patients had metabolic syndrome. When compared to the prevalence of metabolic syndrome, in US adults, was found to be around 28% for men and 30% for women as shown by the National Health and Nutrition Examination Survey (NHANES) carried out by Ford et al.⁷

The study conducted by K. K. Chandra et al.⁸ revealed a similar higher prevalence of metabolic syndrome in females 46.6% than males (29.9%) in patients with essential hypertension. In a study conducted by Chou et al.⁹ in a Chinese population hypertension was linked to metabolic syndrome in women and not in men. They suggested that the role of sympathetic activity in pathogenesis of hypertension in women may be more dependent on insulin resistance than in men. Thus metabolic syndrome is more common in female with essential hypertension. This could also be attributed to the fact that an abnormal waist circumference of 88 cm

and low HDL-C of ≤50 gm% is easily achieved in females.

The most abnormal parameter detected was HDL-C (91.57%) among subjects with metabolic syndrome. This was also the most common abnormal parameter in males as well as females. In NHANES study the low HDL-C was most common abnormal parameter in both male and female. A study conducted by KK Chandra et al the abnormal HDL-C was the most common abnormality in men and an abnormal waist circumference was the most common abnormality in women.⁸

Another parameter TG/HDL-C ratio has been shown to be a good surrogate marker for hyperinsulinemia, as fasting blood sugar and it provides an independent risk estimate for the CAD. Our study showed that TG/HDL-C ratio of >3 had best correlation with the presence of metabolic syndrome. This is comparable with study conducted by KK Chandra et al in which the ratio of >3 was found to have a sensitivity of about 70 % to diagnose the metabolic syndrome.⁸ The study conducted by Jorgen Jeppensen et al. observed that hypertension and a high TG/HDL-C ratio are components of metabolic syndrome and when high TG/HDL-C is present several other important risk factors will also frequently be present to increase the risk of IHD independent of the level of blood pressure and the use of antihypertensive medications. This explains that TG/HDL-C ratio is an important surrogate marker of insulin resistance and why the control of blood pressure alone has not produced the desired reduction in CVD.¹⁰

An effective action plan is needed to combat metabolic syndrome in order to prevent its consequences and to contain the costly management of its complications. Simple but active measures for health promotion, such as adoption of healthier eating habits, increased physical activity and maintenance of normal body weight should accompany vigorous management and control of blood pressure.

CONCLUSIONS

Metabolic syndrome is present in a high proportion 44.5% of our sample of patients with hypertension. The prevalence of metabolic syndrome was higher in women 62.92% (n=56) as compared to men 37.08% (n=33). TG/HDL-C ratio of >3 had best correlation with the presence of metabolic syndrome.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: Not required

REFERENCES

1. Reaven GM. Bunting lecture 1988, Role of insulin resistance in human disease. *Diabetes*. 1988;37:1595-607.
2. Alberti KG, Zimmet PZ, Shaw J. Metabolic syndrome; a new world-wide definition. A consensus statement from the international Diabetes federation. *Diabet Med*. 2006;23:469-80.
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). *J Am Med Assoc*. 2001;258:2486-97.
4. Pouliot MC, Despres JP, Nadeau A, Moorjani S, Prud Homme D, Lupien PJ, et al. Visceral obesity in men. Association with glucose tolerance, plasma insulin and lipoprotein levels. *Diabetes*. 1992;41:826-34.
5. Despres JP. Health consequences of visceral obesity. *Ann Med*. 2001;33:534-41.
6. Braunwald E. Hypertension. In: Douglas P. Zipes, Peter Libby, Robert O. Bonow, Eugene Braunwald, eds. *Braunwald's Heart Disease: a Textbook of Cardiovascular Medicine*. 7th ed. Philadelphia: Saunders; 2005: 1953.
7. 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.
8. Chandra KK, Mahotra S, Gupta M, Ubowega A, Jain S, Kumari S, et al. Prevalence of metabolic syndrome among patients with essential hypertension in the hypertension clinic of a North Indian tertiary care hospital. *Indian J Cardiol*. 2004;7:27-31.
9. Chen CH, Len KC, Tsai ST, Chou P. Different association of hypertension and insulin related metabolic syndrome between men and women in 8437 non-diabetic Chinese men. *Am J Hypertens*. 2000;61:29-37.
10. Jorgen Jeppenson, Hans Olehedin, Paul Saudican, Finn Gnttelberg. High triglycerides and low HDL cholesterol and blood pressure and the risk of ischemic heart disease. *Hypertension*. 2000;36:226.

Cite this article as: Akholkar PJ, Gandhi AA, Shah CM. The metabolic syndrome among hypertensive patients: a cross-sectional study. *Int J Adv Med* 2015;2:188-91.