

Prevalence of Metabolic Syndrome in Hypertensive *De Novo* Patients at a Tertiary Care Hospital

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ABSTRACT

Background: Hypertension is a significant risk factor for the development of cardiovascular disease (CVD), a leading cause of mortality worldwide. Increasing blood pressure could be a marker for metabolic syndrome (MtS) usually undiagnosed, together, which intensify the risk of future development of CVD. **Methodology:** Present prospective, open labeled, observational study was conducted at outpatient department of Mahatma Gandhi Memorial Hospital in Warangal, Telangana, India. The study was carried out for four months, from June 2013 to September 2013. Patients who met the study preset criteria and consented were enrolled and the entire parameters essential for evaluation of MtS were done by using standard techniques from the protocol. **Results:** A total of 120 hypertensive patients (75 male; 45 female) with mean age of 53.28 ± 12.98 years was examined. When classified according to National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III) for MtS, 82.5% were falling in this criterion. Of this total, 43%, 30.8% and 8.33% were met with HTN with 2, HTN with 3 and HTN with 4 criteria respectively. **Conclusion:** A significant prevalence of MetS among newly diagnosed hypertensive patients was observed. In view of this there is a need to screen all hypertensive patients for the abnormalities at the time of diagnosis and an effective action plan is needed to combat MtS in order to prevent its consequences.

Key words: Hypertension, Metabolic Syndrome, National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III).

INTRODUCTION

The Metabolic Syndrome (MtS) as defined by the National Cholesterol Education Programme Adult Panel III (NCEP-III) criteria is a constellation of fasting lipids and lipoproteins, waist circumference, glucose and blood pressure (BP) abnormalities that have been associated with increasing risk factor developing Cardio Vascular Disease (CVD) and Diabetes. World Health Organization (WHO) has defined elevated BP as MtS component as $\geq 140/90$ mmHg. The third report of Expert Panel on Detection Evaluation and Treatment of High Blood Cholesterol in Adults (ATP-III) and the American Association of Clinical Endocrinologists have defined elevated BP associated with the MtS to be $\geq 130/85$ mmHg.¹ The presence of MtS in patients with Hypertension (HTN) significantly

inflates economic burden and costs are likely to increase in the future due to an ageing population and increase in the prevalence of components of MtS.² Early treatment of MtS components decreases morbidity and mortality.³ A recent study from Karachi shows that a large population has the MtS and is overweight or obese.⁴ Systolic Blood Pressure (SBP) in male adolescents is an independent predictor for MtS and could be included in routine metabolic risk assessment.⁵ This underscores the importance of routine screening of Hypertensive patients for other CVD risk factors.⁶ The present study was aimed to evaluate the incidence of MtS in Hypertension *de novo* patients to predict the risk of complications associated with MtS at early stages.

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MATERIALS AND METHODS

Study site: It is a prospective, open labeled, observational study and was conducted at the Medical and General Outpatient clinic of Mahatma Gandhi Memorial (MGM) Hospital in Warangal, Telangana, India. The study was conducted over a period of four months i.e., from June 2013 to September 2013.

Data collection: The Institutional Review Board approved the protocol and all the patients who are visiting the outpatient department were reviewed intensively on daily basis and patients who met the preset study criteria were enrolled. The BP was measured using standard adult arm cuff of a mercury type sphygmomanometer. Measurement of Height was done by using stadiometer with the subject unshod, feet together, arms by the sides and in an erect posture. Weight was measured to the nearest 0.5 kg using a weight scale with the subject wearing only light clothing. Waist circumference (WC) was measured in a horizontal plane midway between the inferior margin of the ribs and 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 inches was used for the measurement. The plane of the tape was parallel to the floor and the tape was fitted snugly, but did not compress the skin. The measurements were recorded at the end of normal inspiration.

Laboratory evaluation: The instruction was given to the enrolled patients on their first day of the presentation to the clinic and blood samples for the laboratory investigations were taken during the patient's second visit, after instructing at their first visit to carry out an

overnight (i.e. 9-12 hours) fast on the night preceding their second visit. All the laboratory tests were done in the chemical pathology laboratory of the MGM hospital, Warangal, Telangana. The samples were stored in a deep freezer at a temperature of about -10°C till biochemical analysis was done. Fasting blood glucose was determined by the Glucose oxidase method,⁷ serum triglycerides,⁸ total cholesterol,⁹ and HDL cholesterol¹⁰ were determined by using enzymatic colorimetric methods.

Definitions

Hypertension is usually defined as systolic reading ≥ 140 mm Hg and a Diastolic reading ≥ 90 mm Hg ($\geq 140/90$).¹¹ The diagnosis of the Metabolic Syndrome was based on the NCEP-ATP III working definition.¹² Using this definition the subjects were regarded as having metabolic syndrome if they had any three or more of the following conditions:

High BP defined as systolic BP greater than or equal to 130 mmHg and Diastolic BP greater than or equal to 85 mmHg

High fasting blood glucose (FBG) defined as fasting blood glucose greater than or equal to 110 mg/Dl (6.1 mmol/L)

Low HDL cholesterol defined as plasma HDL cholesterol less than 40mg/Dl (1.03mmol/L) for male and less than 50 mg/Dl (1.3 mmol/L) for female

Abdominal obesity defined as waist circumference greater than 40 inches (102 cms) in male and greater than 35 inches (88 cms) in female

Hypertriglyceridemia defined as fasting plasma triglycerides greater than or equal to 150 mg/Dl (1.7 mmol/L) for both male and female.

Table 1: Mean values of Anthropometric, Clinical and Biochemical variables in the study population

	All Subjects	Male	Female	p value	significance
Age	53.28 ± 12.98	53.78 ± 13.85	53.78 ± 11.53	1	ns
SBP (mm Hg)	142.91 ± 8.24	142.71 ± 8.43	143.3 ± 7.97	<0.0001	***
DBP (mm Hg)	93.92 ± 5.39	94.53 ± 5.76	92.89 ± 5.48	0.1067	ns
MAP	110.1 ± 5.64	110.42 ± 5.95	109.7 ± 5.11	0.5006	ns
W/H ratio	1.11 ± 0.11	1.13 ± 0.10	1.07 ± 0.12	0.0038	**
BMI (kg/m ²)	26.39 ± 3.35	26.14 ± 3.43	26.82 ± 3.22	0.9998	ns
WC (cms)	39.20 ± 4.72	39.77 ± 5.02	38.24 ± 4.05	<0.0001	***
FBS (mg/dl)	91.55 ± 12.75	91.78 ± 12.99	91.16 ± 12.47	0.5061	ns
TG (mg/dl)	168 ± 54.20	173.35 ± 60.33	139.2 ± 41.19	0.0011	**
TC (mg/dl)	179.55 ± 43.3	178.12 ± 47.39	182 ± 35.91	0.6368	ns
HDL-C (mg/dl)	42 ± 9.17	40.81 ± 8.37	43.82 ± 10.21	0.0025	**
LDL-C (mg/dl)	106.43 ± 42.7	166.91 ± 42.93	107.9 ± 33.47	<0.0001	***
VLDL (mg/dl)	32.66 ± 14.77	32.95 ± 13.32	32.16 ± 17.07	0.7780	ns

Values are expressed as Mean ± SD using Student 't' (nonparametric) test. **SBP:** Systolic Blood Pressure, **DBP:** Diastolic Blood Pressure, **MAP:** Mean Arterial Pressure, **W/H:** Waist to Hip ratio, **BMI:** Body mass Index, **WC:** Waist Circumference, **FBS:** Fasting Blood Glucose, **TG:** Triglycerides, **TC:** Total Cholesterol, **HDL-C:** High Density Lipoproteins, **LDL-C:** Low Density Lipoproteins, **VLDL:** Very Low Density Lipoproteins.

Data analysis

The Data was analyzed by using Graph Pad Prism (version 5) software. Simple Descriptive statistics was used to present the demo graphic characteristics. Student t-tests were used to compare continuous variables. A P value less than 0.05 was considered as statistically significant.

RESULTS

The Study Population comprised of 120 hypertensive patients in which, the male patients were 75 (62%) and female patients were 45 (38%). The mean value for the onset of Hypertension in the study population was 1.93 ± 2.01 . The mean age of the total population is 53.28 ± 12.98 . The Mean values of various anthropometric, clinical and biochemical variables measured are summarized in Table 1.

Socio demo graphic data shows 18.33% of male were Smokers, 34.16% were Alcoholics. Most of them were Non Vegetarians (62.5%). All the female in the study were Non Smokers and Non Alcoholics and 35.83% were Non Vegetarians.

The prevalence of five parameters for diagnosing MtS in HTN patients according to NCEP ATP III criteria is shown in Figure 1. Elevated TG showed the highest prevalence in male being present in 41.66% of total study subjects followed by increased WC (35.83%) and Low HDL-C (29.16%). Abnormally elevated FBG was present in 20.83% of male participants. Each of these, three parameters were significantly more prevalent among male when compared to female ($P < 0.0001$, 0.0001, 0.0025). All the subjects were HTN; hence they all met the criteria of elevated BP $\geq 130/85$ mmHg.

Figure 2 show that the total of 82.5 % of the study participants was meeting the criteria of MtS. In which, male were 46.66% and female were 35.83%. Also a large proportion of the subjects (35.83%) were at a high risk of developing MtS since they already met 2 of the NCEP-ATP III criteria.

The relationship between the prevalence of MtS and age is shown in Figure 3. MtS was more prevalent in 50-60 year old hypertensive patients in the present study. It progressively increased from young age population then slightly declined at 40-50 years of age and again rose up to the peak at the age of 50-60 years. Then it declined slightly at 62-71 years of age group and even further declined in those aged 72 years and above.

DISCUSSION

Metabolic syndrome is characterized by the simultaneous occurrence of several metabolic and non-metabolic

abnormalities that result in a marked increase in cardiovascular morbidity and mortality.¹⁴ Meigs *et al* reported Hypertension is the important CVD risk factor with high global prevalence. It is the most commonly identified component of the MtS.¹³ When HTN and other metabolic risk factors co-exist in an individual, they potentiate one another leading to a synergism that increases the total CVD risk well above that which results from the sum of the individual risk factors. Recognition of this fact has led to a reorientation with regard to risk stratification and management of hypertension.^{14,15} Present study has followed NCEP-ATP III criteria and the prevalence of MtS was high in male (81.66%) than in female (46.66%). This result is much higher when compared to the results of Surender Thakur *et al* (68.6%).¹⁶ Central obesity was the most common component of MtS. Among the patients in the present study male (35.83%) are having high prevalence of central obesity than female (31.66%). The identification of obesity as the most frequent component of the MtS had previously reported by Ulasi *et al*⁷ among the hypertensive cohort in their study population. A similar finding had been reported in several other African studies by Dodani *et al*.¹⁸ On a global scale, obesity prevalence continues to worsen both in developed and developing countries. This epidemic is now followed by a worldwide epidemic of metabolic syndrome. Younger children and adults are being faced with the dangers of dietary indiscretion and physical inactivity according to Eirini *et al*.¹⁹ The Prevalence of MtS has been reported in numerous studies to increase progressively with increasing Age. In the present study, the prevalence was more significant at the age of 52-61 years and moderately at the age of 32-41 years declined even further in those aged 72 years and above. Ulasi *et al*⁷ reported similar pattern in nearby Enugu, while Kellinky *et al*²⁰ reported a similar finding among their male patients only. The reason for this may be due to the fact that advancing age affects all levels of pathogenesis which likely explains why the prevalence of MtS with advancing age. For example aging is associated with evolution of insulin resistance, other hormonal alterations, and increase in visceral adipose tissue according to Kannel *et al*⁵ of which are important in the pathogenesis of the MtS. In this study population, mean values of BMI and WC exceed upper normal limits. Present study also found that mean total cholesterol levels were above 200 mg/dL (upper limit of normal range-ULN) in women and for the whole group. Mean HDL Cholesterol levels were below lower normal limit for both male and female equally having lower HDL levels. While mean TG levels are above 150 mg/dL (ULN) in male than female. A likely explanation for these findings is that improper nutrition and sedentary lifestyle a very low proportion of study samples were

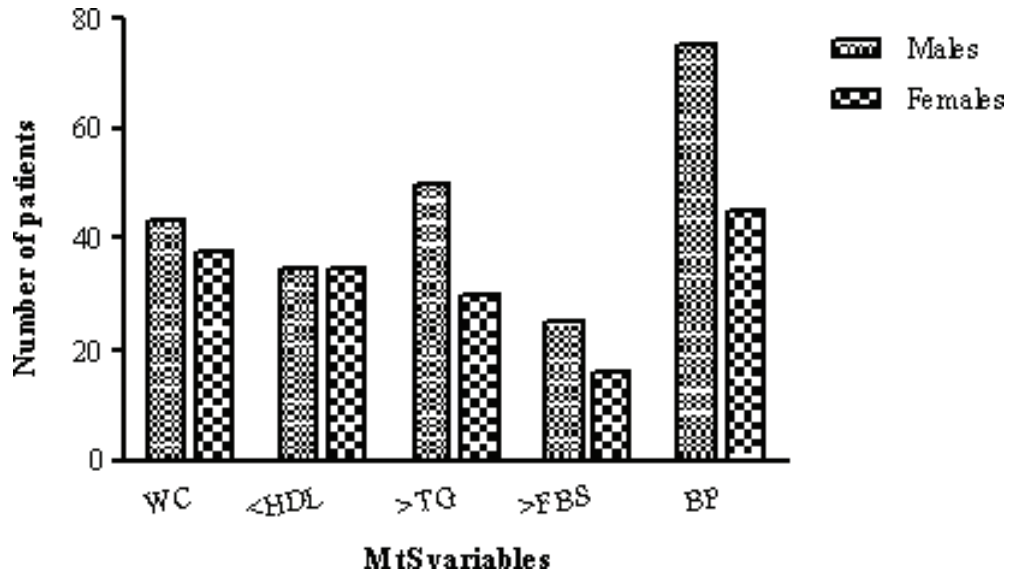


Figure 1: Prevalence of different components of MtS in Hypertensive Patients.

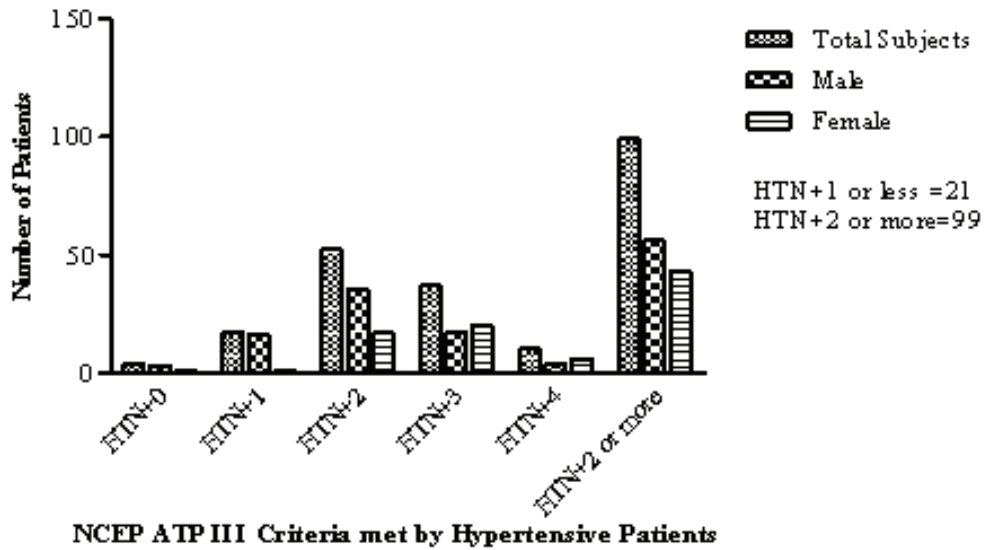


Figure 2: NCEP ATP III criteria met by the participants.

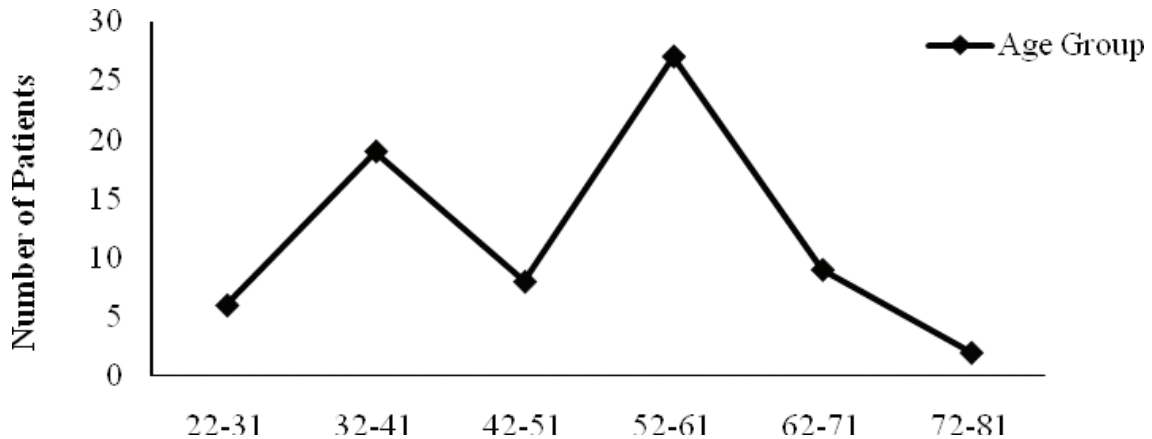


Figure 3: Frequency of MtS in various age groups.

engaging in regular physical activity may be implicated in the high frequency of metabolic syndrome in patients with hypertension.

CONCLUSION

Hypertension is the key component of the Metabolic Syndrome. The frequent association between hypertension and multiple risk factors for CVD is more than a chance finding. In patients with MtS a multitarget approach based on the assessment of the overall cardiovascular risk should be applied. In conclusion, the MtS was highly prevalent in hypertensive patients, especially in Male (46.66%) than Female (35.83%) patients which provides a clinically useful index of the severity of the MtS. Present study has shown a significant prevalence of MtS among newly diagnosed Hypertensive Patients. In view of this, there is the need to screen all hypertensive patients for the abnormalities that constitute the Syndrome at the time of diagnosis. Better assess for the presence of components of MtS and treat along with HTN simultaneously.

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.

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CONFLICT OF INTEREST

All authors report no conflict of interest.

ABBREVIATION USED

Mts: Metabolic Syndrome; **BP:** Blood Pressure; **CVD:** Cardiovascular Disease; **HTN:** Hypertension; **MGM:** Mahatma Gandhi Memorial; **FBG:** Fasting blood glu-

cose; **HDL:** High density lipoprotein; **NCEP:** National cholesterol education program.

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