Original Article

Profile of Metabolic Syndrome in Newly Detected Hypertensive Patients in India: An Hospital-Based Study

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Abstract

Background: Metabolic syndrome (MetS) is recognized as an emerging threat and interest of public health because the factors defining syndrome are associated with increased risk of mortality and morbidity. Hypertension further adds to risk factor leading to target organ damage. Recognizing the MetS in patients with hypertension provides a great opportunity for more aggressive treatment. **Objective:** The objective of the study is to estimate the prevalence and evaluate the metabolic profile of MetS in newly diagnosed adult hypertensive participants. **Methodology:** This is an hospital-based cross-sectional study. A total of 400 participants with newly detected essential hypertension were included in the study after detailed medical and laboratory investigations done to exclude the secondary hypertension. After the informed consent, a structured proforma was filled containing the demographic data; medical history; physiological parameters such as blood pressure, height, weight, and waist circumference; some laboratory investigations such as lipid profile and fasting blood glucose. Descriptive statistics such as mean and proportion were used. To compare the proportions, Chi-square test was used. Kappa agreement was utilized to know the level of agreement between various criteria defining MetS. **Results:** The prevalence of MetS according to the International Diabetes Federation criteria in the new hypertensive study participants was 50.5% more common in females. One-fourth of young hypertensives was having MetS. Hypertensive patients with MetS show risk factors at significantly higher range than their counterparts. High-density lipoprotein was the most common risk factor present apart from increased waist circumference. There was a wide variation in the prevalence of MetS in the Indian population by different criteria. **Conclusion:** Half of the new hypertensive patients had MetS and thus it becomes very important to screen all the hypertensives at the onset for MetS and treat them aggressively to decrease the cardiovascular events.

Keywords: *Hospital-based, India, metabolic syndrome, new detected hypertensive patient, risk factor*

Introduction

Metabolic syndrome (MetS) is characterized by an array of cardiovascular risk factors such as diabetes and raised fasting plasma glucose, abdominal obesity, high cholesterol, and high blood pressure (BP). Although detected very early in the year 1923, five decades later, i.e., 1980s Reaven coined the term "syndrome X" for this conglomeration of various metabolic abnormalities with insulin resistance being the basic underlying pathophysiologic problem.[1] Since then, the definition and terminology of MetS are continuously evolving. The WHO (1999) given a first working definition of MetS with the presence of diabetes, impaired glucose tolerance, or insulin resistance as mandatory criteria.[2] It was later commented by "the European Group for the Study of Insulin Resistance" which coined the term insulin resistance syndrome.[3] Both were criticized to be highly technical and impracticable. The first clinical definition was released by the National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III) with clear cutoff point for each risk factor, differentiated as per sex for waist circumference (WC) and high-density lipoprotein (HDL). Insulin resistance was not considered mandatory but the presence of three or more risk factor.[4] This was further modified by the International Diabetes Federation that identified central obesity (WC) as an essential component, given with race- and gender-specific WC cutoff and lowers the threshold for several parameters such as WC, BP, and fasting plasma glucose.[5] However, optimum definition is still unknown.

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According to the global burden of diseases 2016 nearly in India, 28.09% of total deaths are attributed to CVD.[6] This increase is attributed to the increased prevalence of coronary risk factors in Indians. It is estimated that around 20%–25% of the world's adult population has the MetS. MetS is recognized as an emerging threat and interest of public health because the factors defining syndrome are associated twice as likely to die from and three times as likely to have a heart attack or stroke compared with people without the syndrome.[5,7,8] National representative study on the prevalence of MetS is not available in India. A recent study in India shows that at least one-third of urban Indians have MetS.[9,10]

BP levels are strongly associated with insulin levels and the degree of insulin resistance. It has been reported that insulin resistance might be involved in the pathogenesis of primary hypertension in up to 40%–50% of cases.[11] MetS is present in up to one-third of hypertensive patients. This not only exposed them to a higher risk of target organ damage but also increased the incidence of cardiovascular complications.[12,13] Hypertension tends to cluster with other metabolic risk factors. Early recognition of MetS in hypertensive patients, therefore, acquires greater clinical relevance to improving prognosis. Recognizing the MetS in patients with hypertension provides a great opportunity for more aggressive treatment, including lifestyle, dietary modification, weight management, and treatment of comorbid factors to attain cardiovascular risk reduction. To our knowledge, there are no studies conducted in India, highlighting the prevalence and metabolic profile of MetS in newly diagnosed adult hypertensive participants.

Objective

The objective is to study the prevalence of MetS in newly detected hypertensive patients, to find the association between risk factors and presence of MetS in newly detected hypertensive patients, and to find the prevalence of risk factors for diagnosed MetS in newly detected hypertensive patients.

Methodology

This was a hospital-based cross-sectional study.

Considering the 52%[14] prevalence of MetS in hypertensive patient, 5% precision, and 95% confidence level, sample size comes to be 384, we recruited 400 newly detected hypertensive patients enrolled from June 16 to December 2017 on the basis of below criteria.

Inclusion criteria

Age >18 years newly detected hypertensive patients (BP >140/90) were included in the study.

Exclusion criteria

Patients who have secondary hypertension, endocrinopathies, long-term medications causing dyslipidemia such as beta-blockers, and steroid use were excluded from the study.

Informed consent was obtained from each patient as per the approved format by the IEC. After obtaining demographic (age, sex, ethnicity, and residential address) medical history was recorded, height, weight, and WC were measured. Standing height was measured nearest to 0.1 cm and weight nearest to 0.1 kg using a calibrated digital weighing machine. The WC measured at the level between the iliac crest and the lower margin of the ribs at the end of expiration. Body mass index (BMI) was calculated and categorized as per the WHO.[15]

Seated BP was measured after at least 10 min of rest, two BP recordings were obtained with the help of aneroid sphygmomanometer after a gap of at least 10 min interval. Physical activity was assessed as per the questionnaire blood sample was obtained for the estimation of fasting blood sugar (FBS) and serum for the estimation of HDL and triglycerides (TGs). All analyses were done in biochemistry laboratory by the automated analyzer in a biochemistry laboratory, with commercially available kits. The International Diabetes Federation (IDF) criteria were used for the diagnosis of MetS as given below in Table 1.[5]

Index of central obesity (ICO)[16] was calculated as ratio WC to height.

Table 1: International Diabetes Federation criteria for the diagnosis of metabolic syndrome

Criteria for diagnosis of MetS	Cut off values
Central obesity (defined as waist circumference × with ethnicity-specific values) for Asian	Male >90 cm Female >80 cm
Plus any two of the following four factors	
Raised triglycerides	≥150 mg/dL (1.7 mmol/L) or specific treatment for this lipid abnormality
Reduced HDL cholesterol	<40 mg/dL (1.03 mmol/L) in males <50 mg/dL (1.29 mmol/L) in females or specific treatment for this lipid abnormality
Raised blood pressure	Systolic BP ≥130 or diastolic BP ≥85 mm Hg or treatment of previously diagnosed hypertension
Raised fasting plasma glucose	FPG ≥100 mg/dL (5.6 mmol/L), or previously diagnosed type 2 diabetes

HDL: High-density lipoprotein; BP: Blood pressure; FPG: Fasting plasma glucose

Data analysis

Data were analyzed in MS Excel 2013 and SPSS 23 by proportion IBM Corp. Released 2015. IBM SPSS Statistics for Windows, Version 23.0. (Armonk, NY: IBM Corp.), mean, and standard deviation. ANOVA and Chi-square test were used to compare means and proportion, respectively. Kappa coefficient was used to find the agreement of IDF with various other criteria for diagnosing MetS.

Results

A total of 400 newly detected cases of hypertension were enrolled in the study. The prevalence of MetS according to the IDF criteria in the new hypertensive study participants was 50.5%. Among those having MetS, 72.27% were females. Compared to study participants not having MetS, cases were 5 years younger, significantly more WC, ICO, TG, BMI, and lower HDL level [Table 2]. Table 3 shows a maximum number of cases belong to middle aged (52.47%) and old aged (32.67%) but 75% of young adults had MetS followed by 60% of middle aged. As WC is obligatory criteria for diagnosis of metabolic syndrome as per IDF criteria, we found 100% of study participants to be having central obesity. The prevalence of HDL as a risk factor was found to be significantly more in females (64.28% vs. 90.41%), whereas FBS was more in males (60.7% vs. 45.2%) [Table 4]. Figure 1 shows that 49%, 33%, and 3% had three, four, and five risk factors, respectively.

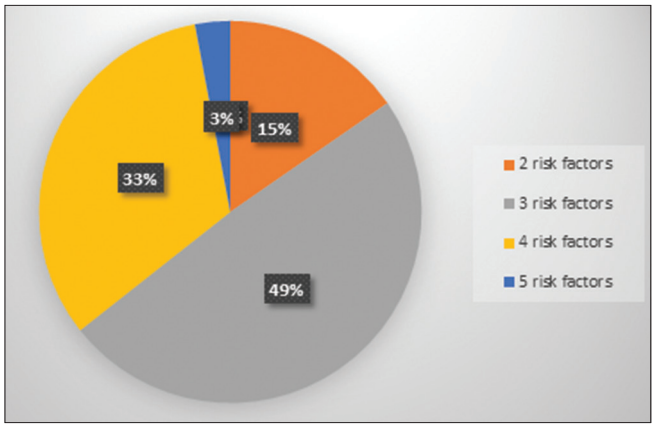

Figure 1: Number of risk factors in patient with metabolic syndrome

In the study participants, the prevalence of MetS by NCEP ATP III was 64.5%, joint interim IDF task force was 60.5%, and as per Parikh and Mohan criteria, considering ICO as obligatory criteria was 68%. Fair agreement (0.519) was found between NCEP ATP III and IDF. Moderate agreement in the diagnosis of MetS was seen between criteria of joint interim IDF task force (0.789) and Parikh and Mohan (0.635) with IDF criteria [Table 5].

Discussion

In this study, 50.5% of the newly detected hypertensive patient had MetS according to the IDF criteria. However, according to the modified IDF criteria for Asian Indian[18] with WC as nonobligatory criteria and presence of three or more factors, the prevalence was much higher, i.e., 60.5%. When NCEP ATP III guidelines were considered the prevalence was 64.5%, and according to Parikh and Mohan criteria, it was 68%. The earlier studies in 2004 showed the prevalence of 30%–35%, but recent studies show more than half of hypertensive patient had MetS.[10,19,20] This prevalence in hypertensive is twice more than the general population.[21] PRESCOT study done in Spain on 12,000 hypertensives shows the prevalence of 52% and 75.5% as per the ATP III and IDF guidelines, respectively.[14] According to the IDF guidelines, 72% of cases of MetS were females and this gender difference was statistically significant which is in line many studies showing comparatively higher prevalence in females, but the gap was only 10%–15% documented till now. Apart from daily household chores, Indian women hardly have access or aware of physical activity exposing them to central obesity. Those having a MetS in study participants were found to be 6 years younger. Though the overall prevalence of MetS was more in middle aged,but proportionately higher number

Table 2: Characteristic of patient with newly detected hypertension by metabolic syndrome

Variables	New hypertensive with MetS (*n*=202)	New hypertensive without MetS (*n*=198)	Difference (CI, *P*)
Sex (male/female percentage)	27.72/72.27	78.78/21.21	48.9, (40.1-57.2, 0.0001)
Age	52±11	57±12	6.14 (3.4-6.5, <0.0001)
Waist circumference	36.57±3.78	31.89±2.73	−20 (−5.1-−4.2, <0.0001)
ICO	0.59±0.06	0.50±0.04	−58 (−58.5-−58.49, <0.0001)
Systolic BP	159±18	160±25	0.64 (−2-4, NS)
Diastolic BP	92±11	93±11	1.28 (−0.5-2.5, NS)
FBS	110±30	107±47	−1.07 (−0.8-2.4, NS)
HDL	40±7	43±14	3.8 (1.4-4.5, 0.0001)
Triglyceride	182±89	148±88	−5.4 (−46-−21.7, <0.0001)
BMI	28.74±4.39	23.22±4.08	−18.4 (−6.1-−4.9, <0.0001)

ICO: Index of central obesity; HDL: High-density lipoprotein; BP: Blood pressure; FPS: Fasting blood sugar; BMI: Body mass index; CI: Confidence interval; MetS: Metabolic syndrome; NS: Not significant

of young adults from total young adults were found to have MetS. This suggests that younger patient detected with hypertension should be meticulously screened for MetS.

Except for FBS, all the risk factors were significantly more in MetS cases. Only one participant was taking the anti-diabetic drug at time of survey. This suggest that inspite being a new case of hypertension and not previously being diagnosed as diabetes those with MetS have comparatively higher level of TG, BMI and lower level of HDL than without MetS group. Therefore it can be concluded that hypertension may be an one of the early marker for MetS. All patient with newly detected hypertension should be screen for MetS in primary care setting.

As WC was obligatory criteria so it was 100% and ICO was 99% and as only hypertensive was considered so it was again 100% in MetS cases. HDL and BMI were the most common risk factor (83.16%) followed by TG and FBS. A similar finding was reported by Makwana *et al*.,[19] while the most common risk factors in Salagre *et al*.[20] and PRESCOT study[14] were fasting blood glucose/DM followed by TG. This difference may be due to strict criteria for selecting an only new hypertensive patient. The study done on normal participants shows hypertension followed by HDL to be the most common risk factor.[21] HDL as a risk factor was profoundly seen in females while BMI and FBS more in males. No correlation was found between the BP and a number of metabolic risk factors might be due to selection criteria and hypertension in the earlier stage if not treated optimally will further lead to the development of risk factors as demonstrated in another study.[14] About 85 % of participants with MetS had three or more risk factors at the time of study. It has been noted in various studies[12,14] that more the number of risk factors, worse is the prognosis.

Considering various criteria for defining MetS, there was the very varying prevalence of MetS found in our study from 50.5% to 68%. When we considered WC as the sole criteria then 18 participants (4%) were categorised as not having MetS. Although these participants were overweight and had more than three risk factors for MetS. Therefore considering only WC as sole criteria for MetS will give comparatively lower prevalence of MetS than other

Table 3: Age and sex distribution of newly detected hypertension by metabolic syndrome

Age	Metabolic syndrome, *n* (%)	*P*
Young adult (25-39 years) (*n*=52)	30 (75)	<0.05
Middle aged (40-59 years) (*n*=176)	106 (60.2)	
Old aged (60 years and above) (*n*=172)	66 (38.37)	
Sex		
Male (212)	56 (26.4)	<0.0001
Female (188)	146 (77.65)	
Total (400)	202 (50.5)	

Table 4: Prevalence of risk factors for metabolic syndrome in newly detected hypertensive patient by sex

Risk factors	Total (%)	Male (*n*=56), *n* (%)	Female (*n*=146), *n* (%)	*P*
Waist circumference	202 (100)	56 (100)	146 (100)	
ICO	200 (99)	56 (100)	144 (98.6)	NS
Hypertension Stage 1	94 (46.53)	24 (42.85)	70 (47.9)	NS
Hypertension Stage 2	108 (53.46)	32 (57.14)	76 (52.05)	NS
FBS	100 (49.5)	34 (60.7)	66 (45.2)	0.002
HDL	168 (83.16)	36 (64.28)	132 (90.41)	<0.0001
TG	128 (63.36)	38 (67.85)	90 (61.6)	NS
BMI	168 (83.16)	50 (89.3)	118 (80.8)	0.01

ICO: Index of central obesity; HDL: High-density lipoprotein; BP: Blood pressure; FPS: Fasting blood sugar; BMI: Body mass index; CI: Confidence interval; NS: Not significant

Table 5: Agreement between International Diabetes Federation with National Cholesterol Education Program Adult Treatment Panel III, Joint interim International Diabetes Federation Task Force; National Heart, Lung, and Blood Institute; American Heart Association, World Heart Federation; International Atherosclerosis Society; and International Association for the Study of Obesity and Parikh and Mohan

Criteria for classification of MetS	MetS(+/-)	IDF[5]		Observed agreement (%)	Kappa coefficient
		MetS (+)	MetS (-)		
NCEP ATP III[4]	MetS (+)	92	37	76.24	0.519 (0.405-0.634)
	MetS (-)	10	61		
Joint interim IDF task force; national heart, lung, and blood institute; AHA, WHF; International Atherosclerosis Society; and International Association for the Study of Obesity[17]	MetS (+)	101	20	89.5	0.789 (705-0.873)
	MetS (-)	1	78		
Parikh and Mohan[16]	MetS (+)	101	35	81.91	0.635 (0.533-0.736)
	MetS (-)	1	62		

IDF: International Diabetes Federation; NCEP ATP III: National Cholesterol Education Program Adult Treatment Panel III; AHA: American Heart Association; WHF: World Heart Federation; MetS: Metabolic syndrome

definitions. The prevalence found by IDF in our study was lowest compared to other criteria while other studies done in Mexican American showed maximum prevalence by IDF.[14,22] No such comparison was found in any study with Indian participants as per our knowledge.

It has been demonstrated by Barrios *et al*.[14] that general practitioners failed to diagnose 43.7% of MetS cases in hypertensive. This will further aggravate the cardiovascular risk if MetS is not aggressively treated timely. We need to choose the best feasible criteria for screening MetS. Among the other three criteria, best (moderate) agreement was found between IDF and joint interim (three or more risk factor).

However, for screening, it is better to the use ICO over WC as WC cutoff given for Asians is still under consideration and it is easiest to calculate and interpret. Moderate agreement was found with IDF and yield a maximum number of cases. If the ratio of WC and height (ICO) is more than half then it is recommended to screen further for MetS.

Conclusion

Half of the newly detected hypertensive study participants had MetS, 2.6 times more in females than males. The MetS cases had risk factors such as WC, ICO, HDL, TG, and BMI at a higher level than non-MetS cases. HDL and BMI were the most common risk factor followed by TG. This finding can be generalized to hypertensive population due to sufficient sample size.

Thus, considering high prevalence and increased cardiovascular risk, all the newly detected hypertensive should be screened for MetS preferably by ICO. There is a need for online medical education for focused management of MetS in hypertensive.

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Conflicts of interest

There are no conflicts of interest.

References

1. Reaven GM. Banting lecture 1988. Role of insulin resistance in human disease. Diabetes 1988;37:1595-607.
2. World Health Organization. Definition, Diagnosis, and Classification of Diabetes Mellitus and its Complications. Available from: http://www.abimbola-foundation.org/files/diabetes-pdf-1.pdf. [Last accessed on 2018 Jan 23].
3. Balkau B, Charles MA. Comment on the provisional report from the WHO consultation. European group for the study of insulin resistance (EGIR) Diabet Med 1999;16:442-3.
4. Third Report of the National Cholesterol Education Program Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) Executive Summary. Bethesda, MD: National Institutes of Health, National Heart, Lung, and Blood Institute; 2001.
5. International Federation of Diabetes; 2006. Available from: http://www.file:///C:/Users/acer/Downloads/IDF_Meta_def_final%20(3).pdf. [Last accessed on 2018 Jan 02].
6. GBD Compare IHME Viz Hub. Available from: https://www.vizhub.healthdata.org/gbd-compare/. [Last accessed on 2017 Oct 25].
7. Lakka HM, Laaksonen DE, Lakka TA, Niskanen LK, Kumpusalo E, Tuomilehto J, *et al.* The metabolic syndrome and total and cardiovascular disease mortality in middle-aged men. JAMA 2002;288:2709-16.
8. Hu G, Qiao Q, Tuomilehto J, Balkau B, Borch-Johnsen K, Pyorala K. Prevalence of the metabolic syndrome and its relation to all-cause and cardiovascular mortality in nondiabetic European men and women. Arch Intern Med 2004;164:1066-76.
9. Misra A, Khurana L. The metabolic syndrome in South Asians: Epidemiology, determinants, and prevention. Metab Syndr Relat Disord 2009;7:497-514.
10. Wasir JS, Misra A, Vikram NK, Pandey RM, Gupta R. Comparison of definitions of the metabolic syndrome in adult Asian Indians. J Assoc Physicians India 2008;56:158-64.
11. Wilcox G. Insulin and insulin resistance. Clin Biochem Rev 2005;26:19-39.
12. Schillaci G, Pirro M, Vaudo G, Gemelli F, Marchesi S, Porcellati C, *et al.* Prognostic value of the metabolic syndrome in essential hypertension. J Am Coll Cardiol 2004;43:1817-22.
13. Cuspidi C, Meani S, Fusi V, Severgnini B, Valerio C, Catini E, *et al.* Metabolic syndrome and target organ damage in untreated essential hypertensives. J Hypertens 2004;22:1991-8.
14. Barrios V, Escobar C, Calderón A, Llisterri JL, Alegría E, Muñiz J, *et al.* Prevalence of the metabolic syndrome in patients with hypertension treated in general practice in Spain: An assessment of blood pressure and low-density lipoprotein cholesterol control and accuracy of diagnosis. J Cardiometab Syndr 2007;2:9-15.
15. World Health Organization. Obesity and Overweight. Available from: http://www.who.int/mediacentre/factsheets/fs311/en/. [Last accessed on 2018 Jan 20].
16. Parikh RM, Mohan V. Changing definitions of metabolic syndrome. Indian J Endocrinol Metab 2012;16:7-12.
17. Alberti KG, Eckel RH, Grundy SM, Zimmet PZ, Cleeman JI, Donato KA, *et al.* Harmonizing the metabolic syndrome: A joint interim statement of the International Diabetes Federation Task Force on Epidemiology and Prevention; National Heart, Lung, and Blood Institute; American Heart Association; World Heart Federation; International Atherosclerosis Society; and International Association for the Study of Obesity. Circulation 2009;120:1640-5.
18. Misra A, Chowbey P, Makkar BM, Vikram NK, Wasir JS, Chadha D, *et al.* Consensus statement for diagnosis of obesity, abdominal obesity and the metabolic syndrome for Asian Indians and recommendations for physical activity, medical and surgical management. J Assoc Physicians India 2009;57:163-70.
19. Makwana D, Bagga S, Nandal M. Prevalence of Metabolic Syndrome in Patients with Essential Hypertension; 2014.
20. Salagre SB, Itolikar SM, Churiwala JJ. Prevalence and clinical profile of metabolic syndrome in hypertensive subjects. J Assoc Physicians India 2016;64:22-4.
21. Pemminati S, Prabha Adhikari MR, Pathak R, Pai MR. Prevalence of metabolic syndrome (METS) using IDF 2005 guidelines in a semi urban South Indian (Boloor diabetes study) population of Mangalore. J Assoc Physicians India 2010;58:674-7.
22. Ford ES. Prevalence of the metabolic syndrome defined by the international diabetes federation among adults in the U.S. Diabetes Care 2005;28:2745-9.