Original Article

Frequency of Metabolic Syndrome in Patients with Hypertension

Metabolic Syndrome in Hypertension

Bilal Habib[1], Shoaib Ahmed[2], Imran Aftab[3], Raza Farrukh[4], Ali Zulqernain[5] and Moizza Sahar[6]

ABSTRACT

Objective: To determine the frequency of metabolic syndrome among the hypertensive patients reporting in the outpatient department of a tertiary care hospital.

Study Design: Cross-sectional study.

Place and Duration of Study: This study was conducted at the Medical OPD of General hospital, Lahore. The present study was conducted from June 2017 to December 2017 over a period of six months.

Materials and Methods: Adult known hypertensive patients of age between the ages 19-50 years were included in the study. The patients satisfying the selection criteria of study were incorporated in the study after informed written consent. Physical examination and laboratory investigations were carried out where required. The data was analyzed using SPSS version 16. Mean ± standard deviations (SD) were recorded for quantitative variables while frequencies were obtained for qualitative variables. The level of significance marked by p-value was determined using independent sample t-test and Chi square test respectively. The p-value of ≤0.05 was considered significant.

Results: A total of 156 known cases of hypertension were enrolled in the study which included 57(36.54%) males and 99(63.46%) females. The patients were screened for MS using the Adult Treatment Panel III-A (ATP-III-A) criteria. Their blood pressure and waist circumference were recorded and fasting blood samples were drawn to measure serum glucose, HDL-cholesterol and triglyceride levels. MS was found in 65.38% (n=102) patients while 34.36% (n=54) patients did not fulfill the ATP-III-A criteria for MS.

Conclusion: MS is highly prevalent among the hypertensive patients and almost two thirds of the study population was found to have MS along with hypertension.

Key Words: Dyslipidemia, Obesity, Metabolic syndrome, Hypertension, ATP-III-A.

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INTRODUCTION

Metabolic Syndrome (MS) is a disorder characterized by concurrence of several known cardiovascular risk factors like obesity, dyslipidemia, insulin resistance and hypertension[1]. In 1998 World Health Organization (WHO) suggested the first modern definition of MS according to which insulin resistance manifested by raised blood glucose or type II diabetes mellitus was the central pathology. Apart from insulin resistance, hypertension, dyslipidemia, elevated BMI (Body Mass Index) and increased urinary albumin excretion were among the other benchmarks of condition[2]. Apart from insulin resistance, an individual with any two of the following features could be considered as a patient of MS:

- Blood pressure greater than or equal to 140/90 mm Hg or a patient taking anti-hypertensive drug/s.
- Plasma triglyceride level ≥ 150 mg/dl.
- High density lipoprotein (HDL) cholesterol less than 35mg/dl and 39mg/dl in males and females respectively.
- Body mass index (BMI) higher than 30kg/m^2 and/or waist/hip ratio (WHR) greater than 0.9 and 0.85 in males and females respectively.
- Urinary albumin excretion ≥ 20 µg/min.

The Third Adult Treatment Panel of The National Cholesterol Education Program (NCEP ATP-III) suggested another criterion for the diagnosis of MS. According to this definition a patient is said to have MS if any three of the following five criteria are found in an individual:

1. Hypertension denoted by a blood pressure greater than 130/85 mmHg.

[1.] Department of Physiology / Biochemistry[2], Rai Medical College, Sargodha.
[3.] Department of Physiology, Independent Medical College, Faisalabad.
[4.] Department of Anaesthesia, DHQ Teaching Hospital Sargodha.
[5.] Department of Psychiatry, Niazi Medical & Dental College Sargodha.
[6.] Department of Hematology, University of Health Sciences, Lahore.

Correspondence: Dr Shoaib Ahmed, Assistant Professor of Biochemistry, Rai Medical College, Sargodha.
Contact No: 0321-6038797
Email: shoaibahmed745@gmail.com

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2. Fasting blood sugar more than 110 mg/dl.
3. Central obesity marked by waist circumference of greater than 40 inches in males and 35 inches in females.
4. Fasting HDL-Cholesterol level of below 40 mg/dl in males and less than 50 mg/dl in females.
5. Fasting triglycerides level beyond 150 mg/dl.

This definition was modified by American Heart Association (AHA) later on and is well-known as the Adult Treatment Panel III-A (ATP III-A) criteria for defining MS. The only change in the criteria is that cutoff value of fasting blood sugar levels has been reduced to 100 mg/dl from 110 mg/dl[3].

The dysfunctional adipose tissue and insulin resistance play an important role in the development and pathogenesis of MS. As a matter of fact the dysfunctional adipose tissue has a vital part in the progression of obesity that eventually leads to insulin resistance[4].

Prevalence of MS is subject to variation depending upon the definition and criterion used for the diagnosis. It also varies with age, gender, race and ethnicity of the study population[5]. Regardless of the criteria used prevalence is high and increasing among the western people, which may be due to outbreak of obesity epidemic[6].

Hypertension which is one of the components of MS may lead to various complications including renal parenchymal damage, peripheral vascular disease and left ventricular enlargement[7]. According to JNC VII (seventh report of Joint National Committee on prevention, detection, evaluation and treatment of high blood pressure) guidelines patient may be diagnosed as a hypertensive, if the systolic and diastolic blood pressures are beyond 140 mmHg and 90 mm Hg respectively. As per JNC VII data more than 50 million people in USA and above one billion worldwide are hypertensives[8]. This study was aimed at finding out the frequency of MS amongst the hypertensive patients in Pakistan. To the best of our knowledge no such data is available for Pakistani population.

MATERIALS AND METHODS

This was a cross sectional study conducted in medical outpatients department of General Hospital Lahore during from June 2017 to December 2017. The study population comprised of 156 subjects. The study included hypertensive patients were 19 to 50 year old belonging to both genders having hypertension. The purposive non-probability sampling technique was applied. The ATP- III-A criterion was used to diagnose the MS in these patients. They were divided in two groups depending upon the presence (Group A) and absence of MS (Group B) according to this criterion. The mercury sphygmomanometer was used to measure the blood pressure according to the standard procedure. The patients were ensured resting comfortably for more than five minutes in supine or sitting position. It was recorded thrice and the mean value was recorded. The measuring tape was used to measure the waist circumference after the patients were asked to hold breath at the end of expiration. As per ATP- III-A, males with waist circumference more than 40 and females more than 35 were labeled to have met the criteria for metabolic syndrome.

RESULTS

This study comprised 156 patients with the age group of 19 to 50 years including males and females. They were cases of hypertension taking antihypertensive medicines. The informed consent was obtained from them. Personal information of the patient and history was taken. Clinical examination was done and observations were recorded. Metabolic Syndrome was found in almost two third of the study population (65.38%) as shown in Figure 1. The mean values of different parameters of MS and age were compared among the two groups as shown in Table 1.The mean age of patients in group A was 42.35±6.28 years as compared to 42.00±8.15 years in group B which was statistically non-significant (p=0.766). The mean±SD systolic blood pressure of group A patients was significantly higher than the group B patients and the value was 166.36±29.50 mm Hg in comparison to 152.33±15.39 mm Hg respectively with a p value of 0.031. However no significant difference in diastolic pressure of two groups was found and mean diastolic pressure of group A was 103.18±16.77 mm Hg while that of group B was 100.00±10.39 mm Hg with statistically non-significant p value of 0.42. As shown in table 3, the mean waist circumference of patients in Group A was 42.84±4.01 inchesin contrast to 40.14±2.82inches in group B patients with a highly significant p-value (<0.001). We observed that insulin resistance marked by fasting blood sugar level >100mg/dl was also found to be significantly higher in group A (132.71±50.31mg/dl) than in group B (89.56±7.36 mg/dl) having a highly significant p-value of <0.001. It was observed in present study that the mean HDL-cholesterol levels of group A was 41.29±5.09 mg/dl compared to 48.72±4.78 mg/dl in group B (p-value <0.001). The mean triglyceride level was 205.03±91.38 mg/dl in group A while it was significantly lower (p<0.001) in group B at 141.33±33.95 mg/dl.

The frequency of MS was compared between two genders and the results are shown in Figure 2. It was observed that MS was more prevalent among female hypertensive patients. The frequency of MS among the male hypertensive patients was 47.36% as compared to 75.75% in the female hypertensives.

The mean values of study parameters were compared for quantitative differences between the two genders (Table 2). The mean age of the male participants of

present study was less (mean age = 40.63±7.63 years) as compared to females (mean age= 43.15±6.37 years) with a statistically significant difference (p=0.029). We could not find a significant difference in the systolic or diastolic blood pressure among two genders. The mean systolic pressure of male patients was 154.89±19.03 mm Hg compared to 155.83±21.82 mm Hg (p=0.374) while the mean diastolic pressure was 99.89±12.08 mm Hg in males and 103.33±10.73 mm Hg among females (p=0.893). The central obesity measured by mean waist circumference had non-significant association with gender i.e. 41.92±4.07 inches in males and 41.89±3.74 inches in females (p=0.960). The difference in mean fasting blood sugar of two genders was statistically non-significant with a p value of 0.49 and the level was 114.42±56.59 mg/dl and 119.70±38.34 mg/dl in males and females respectively. As show table 3, the statistical difference in the mean H Cholesterol level was highly significant between the two genders i.e. mean HDL-cholesterol of 42.05±4.71 mg/dl in males and 44.90±6.58 mg/dl in females (p=0.005).The mean triglyceride levels of the two genders were not significantly different i.e. 195.37±67.21 mg/dl vs. 175.85±89.27 mg/dl in males and females respectively (p=0.154).

Figure 3 shows the frequency of MS criteria in each group. As all the study participants were hypertensives, therefore no difference in the frequency of hypertension could be established between the two groups. The obesity criterion of MS denoted by the waist circumference was met by 88.24% patients in group A as compared to 72.22% participants from group B fulfilling the criteria with a non-significant p-value of 0.12. The most striking difference was in HDL-Cholesterol criteria. The ATP-III-A criterion for HDL was met by 76.47% subjects in group A while none of the patients in group B fulfilled the HDL criteria which was statistically a very significant difference (p<0.001). The frequency of triglyceride and fasting blood sugar criteria were remarkably different amongst the two groups. Almost two-thirds (67.75%) of group A patients met the criteria for both triglycerides and fasting blood sugar while only 11.11% patients of group B met the triglyceride criteria and none of the group B participants had the fasting blood sugar criteria fulfilled (p<0.001).

The observations of the study were recorded in MS word and Excel data sheet. The data was entered and analyzed by using SPSS (Statistical package for social sciences) version 19. The interpretation of the p - value was done as follows.

p >O.05 Difference insignificant
*p < 0.05 Difference significant
**p < 0.05 Difference considerably significant
***p < 0.05 Difference very significant

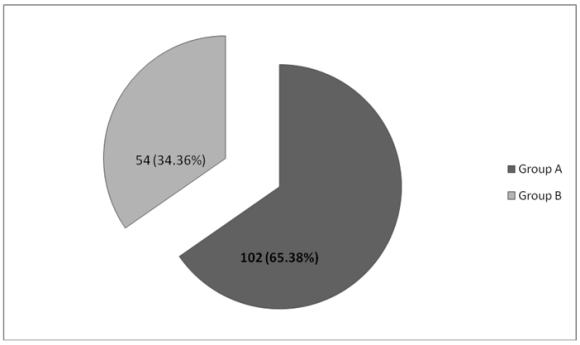

Figure No.1: Frequency of Metabolic Syndrome in the total study population (n=156)

Group A: Hypertensive patients with metabolic syndrome

Group B: Hypertensive patients without metabolic syndrome

Table No.1: Physical & Biochemical parameters of hypertensive subjects with and without metabolic syndrome

Parameter	Group A (n=102)	Group B (n=54)	p-value
Age (Years)	42.35±6.28	42.00±8.15	0.766†
Systolic BP (mm Hg)	166.36±29.03	152.33±15.35	0.031*
Diastolic BP (mm Hg)	103.18±16.77	100.00±10.39	0.42†
Waist Circumference (inches)	42.84±4.01	40.14±2.82	<0.001***
Fasting Blood Sugar (mg/dl)	132.71±50.31	89.56±7.36	<0.001***
HDL-Cholesterol (mg/dl)	41.29±5.09	48.72±4.78	<0.001***
Triglycerides (mg/dl)	205.03±91.38	141.33±33.95	<0.001***

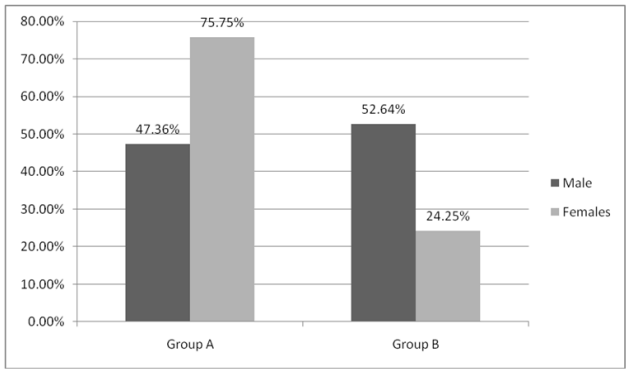

Figure No.2: Gender Distribution of Metabolic Syndrome

Values are expressed as percentages
Group A: Hypertensive patients with metabolic syndrome (n=102)
Group B: Hypertensive patients without metabolic syndrome (n=54)

Table No.2: Physical & Biochemical parameters of study subjects according to gender

Parameter	Males (n=57)	Females (n=99)	p-value
Age (Years)	40.63±7.63	43.15±6.37	0.029*
Systolic BP (mm Hg)	154.89±19.03	155.83±21.82	0.374†
Diastolic BP (mm Hg)	99.89±12.08	103.33±10.73	0.893†
Waist Circumference (inches)	41.92±4.07	41.89±3.74	0.960†
Fasting Blood Sugar (mg/dL)	114.42±56.59	119.70±38.34	0.490†
HDL-Cholesterol (mg/dL)	42.05±4.71	44.90±6.58	0.005**
Triglycerides (mg/dL)	195.37±67.21	175.85±89.27	0.154†
Leptin (ng/ml)	9.33 ±5.61	34.64±24.69	<0.001***
Cortisol (ng/ml)	458.95±214.09	454.44±191.48	0.824†

Values are given in terms of mean ± SD.
*significant at p< 0.05
**highly significant at p<0. 01
***very highly significant at p<0.001
†not significant
n is the number of patients
t test was applied to analyze the data

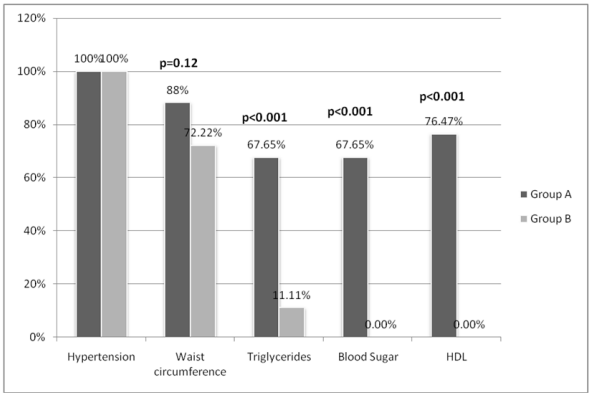

Figure No.3: Frequency of components of metabolic syndrome among study groups
Values are expressed as percentages

DISCUSSION

There is an alarming increase in the prevalence of cardiovascular diseases in recent years all over the world. Hypertension is considered as important risk factor for cardiovascular complications like cardiac failure and stroke[8]. Hypertension is one of the basic components of the metabolic syndrome along with obesity, insulin resistance and dyslipidemia[1].It also plays a key role in the pathogenesis of various features of metabolic syndrome[9]. The high frequency of MS is observed among the hypertensive patients in this study. It is supported by a recent survey showing high frequency in South Asian immigrants indicating their unique body structure and fat distribution[10].

There is a report of prevalence of MS almost three times more in age group of 40 to 59 years than in other age groups and same is the finding of this study[11]. The present study showed high frequency of MS among study groups that implies that hypertensives have more tendency of developing metabolic abnormalities than the general population[12].

The higher frequency of MS in females than males observed in this study is in accordance with the other studies already reported in the literature[13,14]. Obesity is becoming more common in females than males all around the world especially in South Asian countries which is alarming. This may explain the higher frequency of MS in females than males[15].

Central obesity indicated by the waist circumference is a component of MS showing close association with it. There is intimate relation of waist circumference and abdominal obesity leading to cardiovascular diseases. Ulasi et al have also identified the central obesity as the most frequent component of MS. Waist circumference, a measure of adiposity has been found as one of the most important parameter useful in identifying the MS[16,17].

Comparing the individual parameters of MS between the two groups revealed that all the parameters including systolic blood pressure, waist circumference, dyslipidemia (low HDL-cholesterol and high triglyceride) and fasting blood sugar were significantly higher in the hypertensive patients with MS (group A) than the hypertensives alone (group B). The results of Hsu et al and Su et al also revealed a strong association of these parameters with MS among hypertensive patients[18,19].

However no significant difference was found in the diastolic blood pressure of two groups (p=0.42). Mule et al also had similar results with non-significant difference in the diastolic blood pressure of their study groups and the stronger association of systolic blood pressure with MS[20]. Contrary to present result Khan et al reported a stronger association of diastolic blood pressure rather than the systolic blood pressure[9]. Thus the type of hypertension more strongly associated with MS in present study was systolic one although diastolic blood pressure was also higher in the MS group but statistically significant level was not reached. Both the systolic and diastolic blood pressures signify different disease processes leading to a common outcome that is hypertension.

The gender based comparison of the patients with MS (group A) showed that dyslipidemia manifested by

hypertriglyceridemia and low HDL-cholesterol was more profound among males, and statistically significant differences were present which was not in agreement with the observation of Beigh and Jain[21]. However this was in congruence with the observation of Hsu et al[18].

The results of present study suggest that hypertensive patients should undergo regular clinical screening to prevent the development of MS and its hazardous outcomes. The general population should be educated for life style modifications to improve physical activity.

CONCLUSION

MS is highly prevalent among the hypertensive patients and almost two thirds of the study population was found to have MS along with hypertension.

Author's Contribution:

Concept & Design of Study:	Bilal Habib
Drafting:	Shoaib Ahmed, Imran Aftab
Data Analysis:	Raza Farrukh, Ali Zulqernain, Moizza Sahar
Revisiting Critically:	Bilal Habib
Final Approval of version:	Bilal Habib

Conflict of Interest: The study has no conflict of interest to declare by any author.

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