



ORIGINAL RESEARCH PAPER

General Medicine

BURDEN OF MASKED UNCONTROLLED HYPERTENSION IN TREATED HYPERTENSIVE PATIENTS AND EFFECT ON END ORGANS.

KEY WORDS: Masked hypertension, Target organ damage, Hypertension, Damage and Cardiac problems.

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ABSTRACT

Introduction: Masked hypertension (MH) is a condition where patient's office blood pressure measurement reveal a blood pressure below the threshold, but their average ambulatory blood pressure readings are higher than normal. Masked uncontrolled hypertension is seen however in treated hypertensive patients whereby there out of office BP readings are consistently above goal based threshold levels. **Aim:** To estimate the prevalence of masked hypertension and target organ damage in treated hypertensive patients. **Material And Methods:** The present prospective study was conducted in, ASCOMS Medical College and hospital and a total of 100 study subjects were evaluated for masked hypertension and targeted organ damage. All the patients were clinically examined, blood pressure was measured in sitting position after around 20 minutes or more rest in office. Ambulatory blood pressure monitoring, echo and other tests were sent after taking written informed consent from patients or their attendants. Data was collected using a structured clinical proforma. The data that was collected and input into a Microsoft Excel sheet was statistically analysed with the help of SPSS version 22.0. **Result:** The majority of the subjects in our study (30%) were discovered to be between the ages of 46 and 50. The male to female ratio was 1.43:1, with men making up the majority of the study participants. The majority of the research participants (52%) belonged to the middle class. The majority of research participants were smokers and drinkers. The masked hypertension was linked with targeted organ damage. **Conclusion:** The study concluded that 25% of patients had masked hypertension, and that their left ventricular mass index, maximal intima media thickness of the carotid artery, and urine albumin level were significantly different from those of other patients.

INTRODUCTION

Masked hypertension is defined if mean blood pressure is at or above the threshold for hypertension based upon out-of-office readings and mean blood pressures below the threshold for hypertension by office-based readings. It is linked to a poor cardiovascular prognosis. The exact mechanism by which treated hypertensive patients disguised hypertension alters target organ damage is still unknown.¹

When a patient's office measurements show a blood pressure of less than 140/90 mmHg but mean of their ambulatory blood pressure readings is greater than normal, this condition is known as masked hypertension (MH).^{2,3}

Studies comparing the long-term consequences of controlled versus disguised uncontrolled hypertension revealed that disguised uncontrolled hypertension increases the risk of cardiovascular events and all-cause death across all ethnic groups. Although more prevalent in young but in elderly population, uncontrolled MH was more lethal than controlled hypertension.^{4,5}

The most prevalent type of masked hypertension is morning hypertension. It can be brought on by short-acting antihypertensive medication use. Other factors include natural circadian fluctuation, and evening alcohol intake. Stress, either physical or mental, and frequent smoking are examples of lifestyle variables that might contribute to daytime hypertension. Many disorders can potentially result in non-dipping state. These include excessive salt consumption, renal dysfunction, obesity, sleep apnea, and autonomic failure, all of which can cause hypertension at night.

As reported in various studies when compared to normal blood pressure, masked hypertension is a blood pressure trait linked to a higher risk of both fatal and nonfatal cardiovascular events.^{7,8,9}

Aortic stiffness, high pulse wave velocity (PWV), proteinuria,

left ventricular hypertrophy, increased carotid intima-media thickness (IMT), asymptomatic cerebral infarction, and early hypertensive retinopathy are among the target organ damage observed in patients with masked hypertension. These occult phenomena are significantly associated with this damage.¹⁰⁻¹³

AIMS AND OBJECTIVES

To estimate the prevalence of masked hypertension and target organ damage in treated hypertensive patients.

MATERIAL AND METHODS

The present prospective observational study was conducted at ASCOMS hospital Jammu, over a period of 1 year w.e.f. 01/03/24.. after obtaining the Ethical permission from the organization. A total of 100 study subjects were included in the study after obtaining the informed consent.

Inclusion Criteria:

1. 25-65 years of age.
2. Chronically treated patients of hypertension.
3. Patients taken antihypertensive drugs for 1 year.

Exclusion Criteria:

1. Patients who were not willing to participate.
2. Patients who failed to follow up.
3. Patients with history of secondary hypertension, ischemic heart disease, congestive heart failure, chronic glomerulonephritis, renal failure and nephrotic syndrome.

A detailed history was collected and clinical examination was done for all the study subjects. Blood pressure was measured in sitting position after ≥ 20 min of rest by Diamond BPDG 141 Delux Multicolor LED Mercury Free BP Monitor sphygmomanometer. The 20 minute break was selected to increase accuracy and patient was all the necessary instructions especially not to have tea/coffee and both examiner and patient were instructed not to talk. Systolic and diastolic blood pressure were recorded and charted for office. The arm with higher blood pressure reading was selected for both office and ambulatory BP measurement

.Ambulatory BP readings were taken after first taking informed consent from patient. The patiens were taken to a separate room and appropriate cuff was attached in the arm with higher BP reading. The patients were advised to bring the ABPM device report with them on follow up and the data was analysed. The device used for office BP measurement was Diamond BPDG 141 Delux Multicolor LED Mercury Free BP Monitor and for ABPM, Contec ABPM device was used. Along with blood pressure monitoring all patients underwent trans-thoracic echocardiography(TTE). It was done using Philips echocardiography, Philips Affiniti CVx device. Carotid doppler was also done using Voluson S8 by GE Healthcare and laboratory test. A single observer recorded the echocardiographic and carotid doppler findings.It was done to avoid inter-observer bias and subjective error. Biochemical measurements (lipid profile, triglyceride level, Glucose level, HbA1c, urine routine and creatinine level) were also sent. The investigations were used to assess target organ damage.

Using a clinical proforma that was structured, the data was gathered. SPSS version 22.0 was used to assist with the statistical analysis of the data that was gathered and entered into a Microsoft Excel sheet.

RESULTS AND OBSERVATION

Table 1: Demographic Profile of Study Participants

Variable	Category	Frequency (%)
Age Group (years)	46–50	30
	Other age groups	70
Gender	Male	59
	Female	41
Male:Female Ratio		1.43:1
Socioeconomic Status	Middle Class	52
	Others	48
Residence	Urban	Majority
Smoking Status	Smoker	Majority
Alcohol Use	Alcoholic	Majority

Table 1 shows the demographic profile of study participants. In our study it was found that most of the study subjects were in the age group of 46-50 years (30%). Majority of the study subjects were males and the male female ratio was 1.43:1. Most of the study subjects were from middle class (52%) and were living in urban area. Most of the study subjects were smoker and alcoholic.

Table 2: BMI

BMI	Number	Percentage
Underweight	5	5
Normal	51	51
Overweight	34	34
Obese	10	10

Table 2 depicts the BMI among study participants. In our study it was observed that 51% participants had normal BMI whereas 34% participants were overweight and 10% participants were obese. Further, only 5% participants were underweight in our study.

Table 3: Prevalence Of Masked Hypertension

Type of hypertension	Number	Percentage
Masked hypertension	25	25
White coat hypertension	19	19
Controlled hypertension	66	66

In our study the prevalence of masked hypertension was 25% as shown in table 3.

Table 4: Clinical Parameters Of Patients With Masked Hypertension (n=25)

Parameters	Mean±SD
Total cholesterol (mmol/L)	225mg/dl ± 30mg/dl
Triglycerides (mmol/L)	109mg/dl ± 55mg/dl

HbA1c (%)	5.6 ± 0.9
HOMA index	1.7 ± 1.3
Creatinine clearance (ml/min)	88 ± 34

The present study shows that among patients with masked hypertension the mean total cholesterol level was 225+ 30 mg/dl mean triglycerides was 109+ 55mg/dl ,mean HbA1c was 5.6 ± 0.9%, mean HOMA index was 1.7 ± 1.3 and mean creatinine clearance 88 ± 34 ml/min as presented in table 4.

Table 5: Blood Pressure And Heart Rate Of Patients With Masked Hypertension (n=25)

Parameters	Mean±SD
Office BP (mm Hg)	
Systolic	135±8
Diastolic	80±9
Ambulatory BP (mm Hg)	
24 hour Systolic	140±8
24 hour Diastolic	84±7
Daytime systolic	146±9
Daytime diastolic	86±6
Night time systolic	128±10
Night time diastolic	76±9
Heart rate (beats / minute)	
Office	70±8
24 hour	72±8
Daytime	70±10
Night time	68±10

There was deviations of ambulatory daytime and night-time blood pressure values as depicted in table 5.

Table 6: Target Organ Damage In Patients With Masked Hypertension

Parameters	Masked Hypertension (n=25)	Controlled Hypertension (N=66)	White coat hypertension (n=19)
LVMI, g/m ²	127.6 ± 21.6	123.9 ± 20.6	101.2 ± 11.5
LVH, %	75.2	71.5	30.6
CCA IMT, mm	1.1 ± 0.4	1.0 ± 0.3	0.8 ± 0.3
CCA diameter, mm	6.5 ± 0.5	6.3 ± 0.7	5.7 ± 0.6
RWT, mm	0.25 ± 0.09	0.28 ± 0.08	0.19 ± 0.06
Prevalence of plaques, %	89	81	69
Creatinine, mg/dL	119.20 ± 55.64	115.19 ± 90.55	86.42 ± 35.68
eGFR, mL/min per 1.73 m ²	65.27 ± 32.16	71.16 ± 30.15	92.64 ± 26.39
Micro-albuminuria per 24 h, mg	20.68 ± 30.56	25.81 ± 34.92	11.75 ± 13.43
Retinal changes			
KWB class I	6 (24.0%)	18 (27.2%)	14(73.6%)
KWB class II	10 (40.0%)	33(50.0%)	3(15.8%)
KWB class III	09 (36.0%)	15(22.72%)	2(10.5%)

Data are presented as means ± SD or n (%) unless other indicated. CCA: common carotid artery; eGFR: estimated glomerular filtration rate; IMT: intimal media thickness; KWB: Keith-Wagener-Barker; LVH: left ventricular hypertrophy; LVMI: left ventricular mass index;RWT:relative wall thickness.

A relatively higher level of creatinine and decreased eGFR was found in the Masked Hypertension group than that in controlled and white coat hypertension group. Microalbuminuria was more in seen surprisingly more in controlled hypertension group than masked hypertensive patients. Albumin/ creatinine ratio was significantly lower in the Masked Hypertension group. A very high rate of advanced retinal changes was found both in Masked Hypertension and controlled hypertension group. However

the grade of microvascular involvement was more frequently observed in masked hypertension group compared with other two groups. A total of 76 percent (19/25) of total masked hypertension patients had grade II and III retinopathy, respectively. The present study further found that left ventricular mass index, maximal intima media thickness of carotid artery and LVH were all increased in masked hypertensive patients than in controlled and white coat hypertension patients as discussed in table 6. All the findings in table 6 further corroborate that masked hypertension is linked with targeted organ damage.

DISCUSSION

Blood pressure (BP) variability is a complex phenomenon with both short- and long-term components. It can be examined using the night-to-day BP ratio or the standard deviation (SD) of BP values throughout a certain time period of the day.¹⁴ A number of negative consequences, including organ damage and cardiovascular and cerebrovascular events, are linked to masked hypertension. Male gender, comparatively young age, stress or increased physical activity during the day, and drinking or smoking habits are all potential indicators of concealed hypertension.¹⁸

In our study it was found that most of the study subjects were in the age group of 46-50 years (30%). Majority of the study subjects were males. The male female ratio was 1.43:1. Most of the study subjects were from middle class (52%). Majority (70%) were living in an urban area. Most of the study subjects were smoker(55%) and alcoholic(51%). Surprisingly, 51% participants had normal BMI whereas 34% participants were overweight and 10% participants were obese. These findings are comparable with the study conducted by Papazafiropoulou A et al. (2011) found that the mean age of the study subjects was 61.9 ± 10.5 years. Among these, 38.9% subjects were smoker.¹⁶ In similar study performed by Algamal AM (2016) observed that the mean age of study subjects was 49.24 ± 14.99 years and majority of the study subjects were males. Most of the study subjects were smoker and obese.¹⁷

It was also found that among patients with masked hypertension the mean total cholesterol level was 225+ 30mg/dl. Their mean triglycerides was 109+ 55mg/dl and mean HbA1c was 5.6 ± 0.9%. HOMA index was also calculated and it was 1.7 ± 1.3. Mean creatinine clearance was 88 ± 34 ml/min. BP monitoring was done and it was found that there were deviations of ambulatory daytime and night-time blood pressure values in a significant number of patients. Lipid profile, as explained above was done which revealed findings similar to the study carried out by Tomiyama M et al. (2006)¹⁸ Also we already know that reverse dipping is associated with higher cardiovascular risk. The risk factors for such a phenomenon are primarily alterations in circadian rhythm, autonomic failure and a lifestyle that supports drinking, smoking and excessive salt intake. Clement DL et al. (2003) reported that in individuals with an office systolic blood pressure of less than 140 mm Hg, the relative risk of cardiovascular events linked to a high 24-hour ambulatory systolic blood pressure (≥ 135 mm Hg) in comparison to a low 24-hour systolic blood pressure (<135 mm Hg) was 2.80 (after correction) or 3.19 (unadjusted).¹⁹

All the above studies were pivotal in the research of masked hypertension after initial lag of more than a decade. The present study found that the prevalence of masked hypertension was 25%. There were significant changes in left ventricular mass index, maximal intima media thickness of carotid artery and urinary albumin level than other patients. All of these findings positively correlate with target organ damage. As already mentioned a significant majority of Masked Hypertension patients had grade II and III retinopathy.. These study outcomes are correlated with the study conducted by Esme M et al. (2020). It was significantly associated with end-organ damage as described. In this study

,left ventricular hypertrophy and urinary albumin excretion were the two elevated indicators of end-organ damage.²⁰ In another study done by Tomiyama M et al. (2006) it was seen that the prevalence of masked hypertension was 22% and patients with masked hypertension, the maximal intima-media thickness, left ventricular mass index, and urine albumin level were considerably greater than in other patients.¹⁸ Fujiwara T et al. (2018) also found that masked hypertension was significantly associated with increased risk of stroke events and other targeted organ damage.²¹

Limitations Of Our Study

Our study has certain limitations. As the current study was conducted in a single study centre with a small number of patients and data was collected one time only. Further, it is recommended that to evaluate and generalize the study findings, a large-scale study involving multi study centres and large group can be done. As well as a comparative study (in terms of treatment pattern, types of antihypertensive drugs, masked hypertension vs other type of hypertension, etc.) can also be performed.

CONCLUSION

The present study concluded that there was a significant link of masked hypertension on target organ damage and the prevalence of masked hypertension was 25%.

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