Asian Journal of Pharmaceutical and Clinical Research
Innovare Academic Sciences
Knowledge to Innovation
Vol 11, Issue 8, 2018
Online - 2455-3891
Print - 0974-2441

Research Article

ASSESSMENT ON PREVALENCE OF HYPERTENSION AND ITS ASSOCIATED RISK FACTORS ALONG WITH MMAS SCORE IN A RURAL COMMUNITY: A HOME BASED SCREENING

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Received: 06 April 2018, Revised and Accepted: 05 May 2018

ABSTRACT

Objectives: In India, a study on hypertension (HTN) prevalence conducted in a community over a period of 3–6 decades showed an increase of 30% in urban population and 10% in rural population. The study aimed to assess the prevalence of HTN and pre-HTN in a rural community and also to find the significance of risk factors which precipitate to it.

Methods: This cross-sectional study was conducted in a rural community of Salem district, Tamil Nadu, India. HTN and pre-HTN was defined by the Joint National Committee 8th report guidelines. Patient data's (sociodemographic variables, lifestyle factors, and medical reports) were collected with the help of questionnaire. Identified hypertensive patients were assessed with MMAS-8 questionnaire.

Results: During the study period of 8 months, 425 subjects were screened and studied for HTN and pre-HTN. More than half (69.4%) of the study group were found to be hypertensive. Of the 295 reported cases, 228 (53.6% of 425) were "known" cases of HTN and 67 (15.8% of 425) were newly diagnosed cases. A positive association ($p<0.05$) was observed between HTN and age, body mass index (BMI), alcohol, and tobacco use other than smoking. 75 patients were found to be prehypertensive, in that 57.3% (43 cases) were male and 42.7% (32 cases) were female. Majority of hypertension patients (66%) were with low adherence than 24% medium and 10% high adherence towards their medications.

Conclusion: Our study concluded that the prevalence of pre-HTN and HTN was higher among the study population, so there is a need for screening of individuals at the early age group. Further studies are needed to observe and confiscate the reasons why majority of hypertensive patients with low medication adherence.

Keywords: Prevalence, Prehypertension, Hypertension, Body mass index.

 DOI: http://dx.doi.org/10.22159/ajpcr.2018.v11i8.26473

INTRODUCTION

Hypertension (HTN) is one of the predominant global risks for mortality and is seen with a drastic rise in developing nations in accordance with rise in age [1]. In 2005, a worldwide data showed that 639 million patients with HTN are seen in low- and middle-income countries and estimated to victimize more than 1.56 billion by 2025 [2]. In India, HTN prevalence conducted in community over a period of 3–6 decades showed an increase of 30% in urban population and 10% in rural population [3]. This increase is attributed to the rapid epidemiological transition accompanied by urbanization, which is occurring in India [4]. Overweight and obesity showed impact on HTN on various studies [5].

HTN, being a major risk factor for cardiovascular diseases, is an important issue of medical and public health. It is the most common condition seen in primary care which leads to myocardial infarction, stroke, renal failure, and death if not detected early and treated appropriately [6]. HTN is the most common comorbidity of diabetes and vice versa [7]. HTN exerts a substantial public health burden on cardiovascular health status and health-care systems in India [8]. Annually, it causes 7.1 million (one third) of global preventable premature deaths [9].

Unfortunately, there is still inadequate awareness about the real dimension of the problem among the general public. Most of the people in the rural community are illiterates, so they will not be aware of various disease states, their progression, and complications. Hence, an attempt was being made to find the prevalence and associated risk factors of HTN and pre-HTN in rural population.

METHODS

Research period

This study was a community-based cross-sectional study, carried out in Valayakaranur and Vattamalai, rural villages near Kumarapalayam town, Salem district, Tamil Nadu, India, for a period of 8 months from September 2016 to April 2017.

Inclusion and exclusion criteria

The study population was selected according to the inclusion criteria. Inclusion criteria included non-pregnant population between 35 and 75 years of age. Subjects for hypertensive screening were selected according to the questionnaire, willing to undergo screening tests, providing a signed consent, and population already diagnosed diabetes and undiagnosed HTN. Patients on antihypertensive medication and who refused to participate were excluded from the study. All the studies were conducted in accordance with the guidelines for Good Epidemiological Practices and after getting approval from the institutional ethical committee.

Appraisement

Based on inclusion criteria, the house-to-house survey was conducted in rural villages. In questionnaire-based survey, details such as patient name, age, gender, present complaints, family history, blood pressure (BP), social history, exercise pattern, and other risk factors associated with HTN were enrolled by interviewing the participants.Medication adherence of identified HTN patients was assessed by using Morisky Medication Adherence Scale (MMAS-8). MMAS-8 has been widely used for assessing patients' adherence to their medications. The first seven items of MMAS-8 have dichotomous responses (Yes/No) to avoid acquiescence bias, whereas the eighth item has 5-point Likert scale response indicating low to high level of adherence. Total summated adherence score range between 0 and 8. Using the standard scoring criteria, a score greater than 2 was considered low adherence (MMAS-8 score > 2), 1 or 2 as medium adherence (MMAS-8 score 1 or 2) and 0 as high adherence (MMAS-8 score 0). The higher scores are indicative of worse adherence. All subjects who answered "yes" for at least one question were considered as non-adherent.

BP was measured using an automated sphygmomanometer by the oscillometric method. Two readings were taken in a resting patient at a 5-min interval, and the average of the two readings was reported. In case of a difference of >5 mmHg in the readings, two more readings were taken in a similar manner, and the average of all readings was reported.

Height was measured with a tape to the nearest centimeter. Subjects were requested to stand upright without any chapels or shoes with their back against the wall, heels together, and eyes direct forward. Weight was measured using a weighing machine and was recorded to the nearest 0.5 kg. Body mass index (BMI) was calculated using the formula: Weight (kg)/height (m^2).

HTN, in "known" as well as "new" cases, was classified as per the recommendations of the 8th Report of the Joint National Committee on prevention, detection, evaluation, and treatment of high BP. Patients without previously reported HTN had a systolic BP ≥140 mmHg or a diastolic BP ≥90 mmHg were considered as "new" cases. Consequently, patients without a previous history of HTN with systolic BP <140 mmHg and diastolic BP <90 mmHg were considered as having non-HTN. Patients who had systolic BP 120–139 mmHg or a diastolic BP 80–89 mmHg were classified as having "pre-HTN." Isolated systolic HTN (ISH) was defined as systolic BP ≥140 mmHg and diastolic BP ≤89 mmHg, whereas isolated diastolic HTN (IDH) was defined as diastolic BP ≥90 mmHg and systolic BP ≤139 mmHg. A pilot study was conducted with 50 subjects in the study population.

Sample size

Using the formula, sample size $n = N*X/(X+N-1)$, where, $X = Z_{\alpha/2}{}^2 * p*(1-p)/MOE^2$, $Z_{\alpha/2}$ is the critical value of the normal distribution at $\alpha/2$, MOE is the margin of error, p is the sample proportion, and N is the population size. If assuming 500 sample sizes, then the MOE is 4.37%. Expected population size of 2000 and assumed sample proportion was 50%, then the sample size was found to be 401. It was also taken into consideration that 5% of all the filled up forms will be incomplete and rejected. Thus, the total sample size taken was 425.

Statistical analysis

Descriptive statistics using mean (M) and standard deviation (SD) were used for analyzing continuous variables such as age and BMI, whereas percentage and frequency were used for categorical variables such as gender and disease prevalence. Chi-square test was used for the comparison or finding the significance between groups. p<0.05 was considered as statistically significant. All the statistical analyses for significance were found by GraphPad Prism version 6.

RESULTS

Of 780 total populations, 425 subjects were screened for HTN based on the study methodology. A total of the study population consist more males (50.8%, n=216) than females (49.2%, n=209), and mean age was 55.75±13.3 years. 69.4% (n=295) were found as hypertensive and 30.6% (n=130) as non-hypertensive.

Prevalence of HTN

More than half (69.4%) of the study group was found to be hypertensive (Table 1). Of the 295 reported cases, 228 (53.6% of 425) were "known" cases of HTN and 67 (15.8% of 425) were newly diagnosed cases. This includes cases which are having ISH and IDH and cases having both diabetes and HTN. 17.6% (75 of 425) were listed as prehypertensive. The prevalence of ISH was 5.2% (22 of 425) and IDH was 2.8% (12 of 425). Significance difference between males (42.1%, n=179) and females (27.3%, n=116) was found in hypertensive cases. The prevalence of ISH was 5.2% (22 patients), in that 90.9% (20 patients) were known cases and only 9.1% (2 patients) were newly diagnosed. The prevalence of IDH was 2.8% (12 patients), in that half of them were known cases and newly diagnosed.

Most of the hypertensive cases were males (42.1%, n=179) in comparison to females (27.3%, n=116) and statistically significant (p=0.0001) when compared with patients without HTN. Of 5.2% (22 patients) with ISH, 59.1% (13 patients) were male and only 40.1% (9 patients) were female. The prevalence of IDH is equal in males and females with six patients each.

A comparison between those with and without HTN is provided in Table 2. The mean age of hypertensive patient was 58±10.2 years and was significantly older (p<0.0001) than that of patients without HTN (52.7±2.1). The age distribution of the patients was also associated (p<0.0001) with HTN status, with highest proportion of HTN seen in 56–65 years (35.2%, n=104). We did not find any significance regarding family history and coexistence of diabetes with HTN than those without HTN.

Of the 295 reported cases, 69 cases (23.4%) consisted of both HTN and diabetes. Alcohol consumption was positively associated with HTN status (p=0.046) and tobacco use, other than smoking, was also found to be significant (p=0.0048). Smoking did not show any statistical significance with HTN in our study.

Changes in BMI were also studied, and it shows positive relationship with HTN and without HTN. A number of hypertensive were more in BMI values of 25–29.9 (26.4%, 78 cases), and it shows increasing with increase in BMI.

Prevalence of pre-HTN

Seventy-five patients were found to be prehypertensive, among which 57.3% (43 cases) were male and 42.7% (32 cases) were female. Gender does not show any statistical significance with pre-HTN. A comparison

Table 1: Represents overall prevalence of HTN

Category	Total number of subjects n=425 (%)	Number of males (%)	Number of females (%)
Overall hypertensive	295 (69.4)	179 (42.1)	116 (27.3)
Known	119 (28)	67 (15.8)	52 (12.2)
Prehypertensive	75 (17.6)	45 (10.6)	30 (7)
Newly diagnosed	67 (15.8)	48 (11.3)	19 (4.4)
ISH	22 (5.2)	13 (3.1)	9 (2.1)
IDH	12 (2.8)	6 (1.4)	6 (1.4)
Non-hypertensive	130 (30.6)	47 (11.1)	83 (19.5)

HTN: Hypertension, ISH: Isolated systolic hypertension, IDH: Isolated diastolic hypertension

Table 2: Comparison between subjects with and without HTN

Variables	With HTN (n=295)	Without HTN (n=130)	p value
Sex n (%)			
Male	179 (60.7)	47 (36.2)	<0.0001**
Female	116 (39.3)	83 (63.8)	
Age categories n (%)			
35–45 years	41 (13.9)	48 (36.9)	<0.0001**
46–55 years	74 (25.1)	31 (23.8)	
56–65 years	104 (35.25)	27 (20.8)	
66–75 years	76 (25.8)	24 (18.5)	
Mean±SD	58±10.2	52.7±2.1	<0.0001**
Coexistence of diabetes n (%)			
Yes	69 (23.4)	34 (26.1)	0.6337
Family history n (%)			
Diabetes	59 (20)	21 (16.1%)	0.4369
HTN	59 (20)	18 (13.8%)	0.2016
BMI n (%)			
<18.5/m^2	38 (12.9)	37 (28.4)	0.0006**
18.5–22.9	50 (16.9)	27 (20.8)	
23–24.9	65 (22.0)	26 (20)	
25–29.9	78 (26.4)	21 (16.1)	
30+	64 (21.69)	19 (14.6)	
Lifestyle factors n (%)			
Smoking past and present	158 (53.5)	88 (67.7)	0.1671
Alcohol consumption (past and present)	149 (50.5)	92 (70.8)	0.046*
Other tobacco use	127 (43.0)	91 (70)	0.0048*

*,**Indicates the significance at the level (p<0.05 and p<0.01). HTN: Hypertension, SD: Standard deviation, BMI: Body mass index

Table 3: Comparison between subjects with and without pre-HTN

Variables	With pre-HTN (n=75)	Without pre-HTN (n=150)	p value
Sex n (%)			
Male	43 (57.3)	69 (46)	0.109
Female	32 (42.7)	81 (54)	
Age categories n (%)			
35–45	33 (44)	23 (15.3)	<0.0001**
46–55	23 (30.7)	38 (25.3)	
56–65	13 (17.3)	59 (39.3)	
66–75	6 (8)	30 (20)	
Mean±SD	49.5±12.3	57.2±9.9	<0.0001**
Coexistence of diabetes n (%)			
Yes	21 (28)	43 (28.7)	0.9378
Family history n (%)			
Diabetes	11 (14.7)	46 (30.7)	0.0398*
HTN	8 (10.7)	41 (27.3)	0.0189*
BMI n (%)			
<18.5/m^2	8 (10.7)	25 (16.7)	0.0085**
18.5–22.9	5 (6.7)	30 (20)	
23–24.9	12 (16)	30 (20)	
25–29.9	29 (38.7)	32 (21.3)	
30+	21 (28)	33 (22)	
Lifestyle factors n (%)			
Smoking past and present	44 (58.7)	101 (67.3)	0.548
Alcohol consumption (past and present)	32 (42.7)	97 (64.7)	0.0927
Other tobacco use	42 (56)	103 (68.7)	0.3778

*,**Indicates the significance at the level (p<0.05 and p<0.01). HTN: Hypertension, SD: Standard deviation, BMI: Body mass index

between those with and without pre-HTN is provided in Table 3.

The mean age of prehypertensive patients was 49.5±12.3 and was significantly younger (p<0.0001) than that of patients without HTN (57.2±9.9). This shows increase in age can predispose to other medical conditions. The age distribution of patients was also associated with (p<0.0001) highest proportion seen in 35–45 years (44%, 33 cases). This result in age distribution shows that pre-HTN in young age can lead to HTN in increasing age.

Coexistence of diabetes does not show any significance with pre-HTN, but family history of diabetes (p=0.0398) and HTN (p=0.0189) shows statistical significance in pre-HTN.

BMI also shows a positive relationship with pre-HTN. Highest number of prehypertensive cases was seen in 25–29.9 years (38.7%, 29 cases). It shows a statistical significance with pre-HTN (p=0.0085). Increase in BMI can cause pre-HTN and later it develops to HTN. This study shows that age and BMI had a significant role in pre-HTN and developing it to HTN.

Lifestyle factors such as smoking, alcohol consumption, and other tobacco uses did not show any significance with prehypertensive in this area of study. Most of the hypertensive patients 61.7% (n=295) were

Table 4: Represents prevalence of HTN based on educational level

Education level	Prehypertensive (n=75)	Newly diagnosed (n=67)	ISH (n=22)	IDH (n=12)	Known (n=119)	Non-hypertensive (n=130)
No education	58 (77.3)	41 (61.2)	11 (50)	9 (75)	63 (52.9)	61 (46.9)
Lower education	11 (14.7)	19 (28.4)	6 (27.3)	3 (25)	51 (42.9)	45 (34.6)
Upper secondary	4 (5.3)	5 (7.5)	5 (22.7)	-	2 (1.6)	17 (13.1)
1st stage of tertiary education	2 (2.7)	2 (3)	-	-	3 (2.4)	5 (3.9)
2nd stage of tertiary education	-	-	-	-	-	2 (1.5)

HTN: Hypertension, ISH: Isolated systolic hypertension, IDH: Isolated diastolic hypertension

Table 5: Represents prevalence of HTN based on physical activity

Physical activity (exercise)	Prehypertensive (n=75)	Newly diagnosed (n=67)	ISH (n=22)	IDH (n=12)	Known (n=119)	Non-hypertensive (n=130)
No physical activities	72 (96)	64 (95.5)	13 (59.1)	10 (83.3)	94 (79)	80 (61.5)
Mild	3 (4)	3 (4.5)	6 (27.3)	2 (26.7)	17 (14.3)	38 (29.2)
Moderate	-	-	3 (13.6)	-	5 (4.2)	5 (3.9)
Regular physical activity	-	-	-	-	3 (2.5)	7 (5.4)

HTN: Hypertension, ISH: Isolated systolic hypertension, IDH: Isolated diastolic hypertension

Table 6: MMAS score in HTN patients

Groups	Score (n-119)		
	Low	Medium	High
Stage 1 HTN (SBP=140-159 or DBP=90-99)	57 (48%)	18 (15%)	8 (7%)
Stage 2 HTN (SBP = ≥160 or DBP = ≥100)	21 (18%)	11 (9%)	4 (3%)

illiterate and 85.7% (n=295) were never had physical activity (Tables 4 and 5). A majority of patients had low adherence (78 of 119, 66%) to medication, followed by medium adherence (29 of 119, 21%) and high adherence (12 of 119, 10%) on MMAS-8 scale (Table 6).

DISCUSSION

Burden of non-communicable diseases such as cardiovascular, cerebrovascular, diabetes, HTN, and cancers has been increasing in India. The study conducted was helpful in finding the significance of early diagnosis of the disease state.

In our study, the prevalence of HTN was significantly higher in males (42.1%) than females (27.3%). The disease was more prevalent in males, as they were having social habits such as smoking, alcohol consumption, stress, and tobacco chewing [10]. In contrast, Matthias *et al.* [11] found that HTN was higher among postmenopausal women due to loss of estrogen production after menopause that leads to elevated BP.

Newly diagnosed hypertensive cases were 23.8% and prehypertensive cases were 17.6%. Our results were contrasted with Singh *et al.* [12], Mohan *et al.* [4], and Ghosh *et al.* [13], where the pre-HTN was higher than HTN. The proportion of HTN was found to increase steadily with an increase in age. Changes, in BP with age, might be due to the physiological changes of blood vessel flexibility might be lost as age increases [14,15]. Findings of our study were in par with Joshi *et al.* [16], Vasan *et al.* [17], and Singh *et al.* [12].

Patients having both diabetes and HTN were highly prevalent in HTN than pre-HTN, which are predisposed to systemic vascular disease [18]. Patients with diabetes were more likely to have uncontrolled BP. Our findings reinforce the reports of Tripathy *et al.* [19]. In this study, positive family history has been predisposed people to HTN. Similar data have been reported by Joshi *et al.* [20]. Subburam *et al.* also reported that family history is significantly associated with HTN [21].

In our study, it was found that increased BMI was significantly associated with HTN. The prevalence of HTN and pre-HTN was found to be consistently increase with increasing BMI, as revealed by other authors [4,12,22,23].

Our study found a positive association between alcohol intake and HTN. Bansal *et al*. and Malhotra *et al.* in their studies also reported the same [23,24]. There is a positive correlation between HTN and alcohol as reported by Grogan *et al.* [25] by explaining the mechanisms like stimulation of RAAS which changes sodium and calcium level in the body and inhibition of nitric oxide production. However, smoking did not show any significance with HTN in this community and using tobacco other than smoking showed a significant relationship. Findings of our study were similar with findings of Aghaji *et al.* [26]. This result is inconsistent with Kishore *et al*. [27], where no significant association was shown with tobacco intake.

Most of the hypertensives and prehypertensives were higher among illiterate group. HTN prevalence decreased with higher education. High prevalence of HTN in low educated group might be the result of low tendency of these people to pay attention to their health and not being informed enough about the things to do or not to do for HTN [28]. Education makes the people aware of the disease and what precautions can be undertaken by the healthy individual [27]. Wang *et al*. also found that both systolic and diastolic BP was inversely associated with the level of school education independent of all other risk factors [29].

In this study, population with no physical activity was highly prevalent in prehypertensive, known case of HTN, ISH, and IDH. People who do not engage in regular exercise are at increased risk for the development of HTN [30]. Mohan *et al.* reported that low physical activity has significant role in the prevalence of HTN [4]. Similar findings were also reported by Kokiwar *et al.* and Malhotra *et al.* [31,24].

From our study, we may conclude that male gender, lack of physical activity, obesity, tobacco and alcohol use, and family history of chronic diseases were associated with pre-HTN and HTN in addition to increase in the age of the population studied. Similar findings were reported from Parthaje *et al*., [32] and Dhianawaty *et al*., [33]. Poor adherence to antihypertensive medications is not only associated with poor BP control but also accelerates development of HTN related complications and increases cost of hospital admissions rate.[34]

The limitation of our study was the inclusion of small population from rural areas, and these results can be varying in urban areas. The subject was limited to one geographic area, and this data vary with other areas in our nation. Relation of BMI with diabetes and HTN is studied here.

However, calculating the waistline circumference is more advised than BMI. Literacy and psychological issues were problem in accuracy of data collection.

CONCLUSION

This study helps in the early detection of HTN and pre-HTN and provided an opportunity to the subjects to prevent the progression of pre-HTN to HTN and its complication. Risk factors such as BMI, family history, alcohol, tobacco, and illiteracy were highly associated with our study subjects. Thus, control of HTN may provide an access point in reduction of other cardiovascular mortalities. Patient with poor adherence may be due to lack of awareness and attitude towards the disease.

ACKNOWLEDGMENT

We wish to thank all the participants in this study and colleagues in the department of pharmacy practice for their support in the execution of this project work.

AUTHORS' CONTRIBUTIONS

KK contributed in study design, data collection, and manuscript writing, SSR contributed in study design, final review, and approval, and KR and KK contributed in statistical data analysis.

CONFLICTS OF INTEREST

All authors have approved the manuscript with no conflicts of interest.

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