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An Epidemiological Study of Prevalence of hypertension and Pre-hypertension and Its Associated Risk Factors in a Rural Community: a Home Based Screening

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Abstract:

Background: In India, a study on hypertension prevalence conducted in a community over a period of 3 to 6 decades showed an increase of 30% in urban population and 10% in rural population.

Aims: The study aimed to assess the prevalence of hypertension and pre-hypertension 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. Hypertension and pre-hypertension were defined by the Joint National Committee 8th report guidelines. Patient datas (socio-demographic variables, lifestyle factors, medical reports) were collected with the help of questionnaire.

Results: During the study period of eight months, 425 subjects were screened and studied for hypertension and pre-hypertension. 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 hypertension and 67 (15.8% of 425) were newly diagnosed cases. A positive association (P<0.05) was observed between hypertension and age, BMI, alcohol and tobacco use other than smoking. 75 patients were found to be pre-hypertensive, in that 57.3% (43 cases) were male and 42.7% (32 cases) were female. Furthermore, another positive association (P<0.05) was observed between pre-hypertension and age, BMI, family history of diabetes and hypertension.

Conclusion: Our study concluded that prevalence of pre-hypertension and hypertension were higher among the study population so there is a need for screening of individuals at the early age group.

Key Words: Prevalence, pre-hypertension, hypertension, BMI.

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 the year 2025.[2] In India, HTN prevalence conducted in community over a period of 3 to 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 (CVDs), is an important issue of medical and public health. It is the most common condition seen in primary care which leads to myocardial infarction (MI), stroke, renal failure, and death if not detected early and treated appropriately.[6] HTN is the commonest co-morbidity of diabetes and verse versa.[7] HTN exerts a substantial public health burden on cardiovascular health status and healthcare 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.

MATERIALS AND 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 eight 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. Patient on anti-hypertensive medication and who refused to participate were excluded from the study. All the study was conducted in accordance with the guidelines for Good Epidemiological Practices and after getting approval from institutional ethical committee.

Appraisement:

Based on inclusion criteria, the house-to-house survey was conducted in rural villages. In questionnaire based survey, details like patient name, age, gender, present complaints, family history, blood pressure (BP), social history, exercise pattern and other risk factors associate with HTN were enrolled by interviewing the participants.

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 > 5mmHg 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 centimetre. 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 0.5kg. Body mass index (BMI) was calculated using the formula: weight (kg)/height (m2).

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 ≥ 140mmHg or a diastolic BP ≥ 90mmHg were considered as "new" cases. Consequently, patients without a previous history of HTN with systolic BP < 140mmHg and diastolic BP < 90mmHg were considered as having non HTN. Patients who had systolic BP 120– 139mmHg or a diastolic BP 80–89mmHg were classified as having "pre-HTN". Isolated systolic HTN (ISH) was defined as systolic BP ≥ 140mmHg and diastolic BP ≤ 89mmHg, whereas isolated diastolic HTN (IDH) was defined as diastolic BP ≥ 90mmHg and systolic BP ≤ 139mmHg. A pilot study was conducted with 50 subjects in the study population.

Sample Size:

By 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 α/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) was used for analysing continuous variables like age and body mass index (BMI) whereas percentage and frequency were used for categorical variables like gender and disease prevalence. Chi-Square test was used for the comparison or finding the significance between groups. A *P* value of <0.05 was considered as significant. All the statistical analyses for significance were found by graph pad prism version 6.

RESULTS:

Out of 780 total populations, 425 subjects were screened for HTN based on the study methodology. 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 hypertension:

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 isolated systolic hypertension (ISH), isolated diastolic hypertension (IDH) and cases having both diabetes and HTN. 17.6% (75 of 425) were listed as pre-hypertensive. 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) were found in hypertensive cases. 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. 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. Out of the 5.2% (22 patients) with ISH, 59.1% (13 patients) were males and only 40.1% (9 patients) were females. Prevalence of IDH is equal in males and females with 6 patients each.

Table 1: Represents overall prevalence of HTN

Category	Total No. of subjects N=425	No .of male	No. of female
Overall hypertensive	295 (69.4%)	179 (42.1%)	116 (27.3%)
Known	119 (28%)	67 (15.8%)	52 (12.2%)
Pre-hypertensive	75 (17.6%)	45 (10.6%)	30 (7%)
Newly diagnosed	67 (15.8%)	48 (11.3%)	19 (4.4%)
Isolated systolic hypertension	22 (5.2%)	13 (3.1%)	9 (2.1%)
Isolated diastolic hypertension	12 (2.8%)	6 (1.4%)	6 (1.4%)
Non-hypertensive	130 (30.6%)	47 (11.1%)	83 (19.5%)

Table 2: Comparison between subjects with and without hypertension

Variables	With hypertension (n=295)	Without hypertension (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**
Co-existence of diabetes [n (%)]			
Yes	69 (23.4%)	34 (26.1%)	0.6337
Family history [n (%)]			
Diabetes	59 (20%)	21 (16.1%)	0.4369
Hypertension	59 (20%)	18 (13.8%)	0.2016
BMI [n (%)]			
<18.5/sq.m	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 & present)	149 (50.5%)	92 (70.8%)	0.046*
Other tobacco use	127 (43.0%)	91 (70%)	0.0048*

*and** Indicates the significance at the level (p<0.05 and p<0.01)

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

Variables	With Pre-hypertension (n= 75)	Without Pre-hypertension (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**
Co-existence of diabetes [n (%)]			
Yes	21 (28%)	43(28.7%)	0.9378
Family history [n (%)]			
Diabetes	11 (14.7%)	46 (30.7%)	0.0398*
Hypertension	8 (10.7%)	41 (27.3%)	0.0189*
BMI [n (%)]			
<18.5/sq.m	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 & present)	32 (42.7%)	97(64.7%)	0.0927
Other tobacco use	42 (56%)	103 (68.7%)	0.3778

*and** Indicates the significance at the level (p<0.05 and p<0.01)

Table 4: Represents prevalence of hypertension based on educational level

Education level	Pre- hypertensive (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%)

Table 5: Represents prevalence of hypertension based on physical activity

Physical activity (Exercise)	Pre- hypertensive (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%)

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 the 56-65 years (35.2%, n=104). We didn't 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, were also found to be significant (*P*=0.0048). Smoking didn't 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. 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-hypertension:

75 patients were found to be pre-hypertensive, among which 57.3% (43 cases) were male and 42.7% (32 cases) were female. Gender doesn't show any statistical significance with pre-HTN. A comparison between those with and without pre- HTN is provided in Table 3.

The mean age of pre-hypertensive 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 doesn't 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 pre- hypertensive cases were seen in 25-29.9 (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 use didn't show any significance with pre-hypertensive in this area of study. Most of the hypertensive patients 61.7% (n= 295) were illiterate and 85.7% (n=295) were never had physical activity (Table 4,5).

DISCUSSION:

Burden of non-communicable diseases like cardiovascular, cerebrovascular, diabetes, HTN and cancers has been increasing in India. 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 like smoking, alcohol consumption, stress and tobacco chewing.[10] In contrast, Matthias[11] *et al.,* 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 pre-hypertensive cases were 17.6%. Our results were contrast with Singh *et al*.,[12] Mohan *et al*.,[4] and Ghosh *et al*.,[13] where the pre-HTN were 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 predispose 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 change sodium and calcium level in the body and inhibition of nitric oxide production. But smoking didn't show any significance with HTN in this community and using tobacco other than smoking showed 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 hypertensives and pre-hypertensives 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, were highly prevalent in pre-hypertensive, 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 have significant role in 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, 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]

The limitation of our study was the inclusion of small population from a rural area and these results can be varying in urban areas. The subject was limited to one geographic area and this data vary with other area in our nation. Relation of BMI with diabetes and HTN are studied here. But calculating the waist line 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 like BMI, family history, alcohol, tobacco, illiteracy were highly associated with our study subjects. Thus, control of HTN may provide an access point in reduction of other cardiovascular mortality.

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