



Prevalence of Pre-hypertension among the Urban Population of Southern India

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ABSTRACT

Introduction: Most of the disease burden because of hypertension is preventable if right action is taken at right time. Public health intervention at the pre-hypertensive stage becomes important in this regard. Hence this study was conducted with an objective to estimate the prevalence of prehypertension and determine the factors associated with prehypertension.

Methods: Cross sectional study with 389 participants was carried out among urban population. Data regarding basic demographic characteristics including anthropometric measurements height and weight were collected. Systolic blood pressure between 120-139 mm Hg and/or diastolic blood pressure between 80-89 mm Hg was taken as cut off values to define prehypertension. Statistical analysis was done using Chi-square test, t-test and multiple linear regression analysis.

Results: Prevalence of prehypertension was estimated to be 33.7%. Various factors such as age, extra salt intake, alcohol consumption, BMI were significantly associated with prehypertension.

Conclusion: There is increasing prevalence of prehypertension. Simple lifestyle modifications such as low intake of salt, reducing alcohol can reduce overall blood pressure. Early intervention would decrease the future burden of hypertension.

Keywords: Prehypertension, Urban area, Risk factors.

INTRODUCTION

One of the extensively researched and established risk factor for cardiovascular diseases is Hypertension. Hypertension is the fourth contributor for premature deaths in developed countries and seventh in the developing countries as reported by The Global Burden of Disease Study¹. The mortality associated with coronary artery disease and stroke increased by twofold for each 20 mmHg increase in systolic blood pressure (SBP) or 10 mmHg increase in diastolic blood pressure over 115/75 mmHg as demonstrated by meta-analysis of approximately one million individuals from 61 long term epidemiological studies². Various Studies have reported that there is increased risk of Hypertension and early death because of cardiovascular disease in the people with blood pressure >120/80 but <140/90 mmHg³.

Out of around 900 million people with hypertension in developing countries only one third of them are aware of their hypertensive status as indicated by world congress of cardiology in 2012.⁴ In India it is estimated that the prevalence of hypertension ranges from 20-40% in urban adults and 12-17% among rural adults^{5,6}

Prevalence of prehypertension according to a study in an affluent urban population in north India was found to be 31%⁷. Among urban residents >18years living in Chennai the prevalence of prehypertension was reported as 47%.⁸ with studies showing such high prevalence of pre-hypertension there is imminent threat of increasing burden of hypertension.

Pre-hypertensive individuals are at increased risk of developing Hypertension and its complications

in the future ^{9,10}. In a study it was observed that the increment in cardiovascular risk associated with progression from normotension to prehypertension is similar to that associated with the progression from pre-hypertension to hypertension¹¹. Thus pre-hypertensive individuals are associated with increased risk of cardiovascular disease related morbidity and mortality on a long term basis. Hence Estimation of Pre-Hypertension in the population becomes important in order to create awareness and implement appropriate preventive measures to decrease the burden of hypertension and its complications.

METHODOLOGY

Study area: This study was conducted at Mysore city (urban) with all 65 wards being the sampling frame. Inclusion Criteria was all Persons who were greater than 30 years of age. Pregnant women, Persons who are not permanent residents of the study area, Severely morbid subjects hospitalized at the time of study, Persons not available during the period of study, People not giving consent for the study were excluded from the study.

Sampling Method: A list of all the wards of Mysore city was taken from Mysore city Corporation. Utilizing this list as a sampling frame, four wards were selected by simple random sampling which was done using random number table. In each ward 100 subjects were covered to make it to the present sample size of 360 subjects¹² by systematic random sampling. One person from each house was included in the study. In each ward there were around 1500 to 2000 houses. In the wards having average 1500 houses the sample interval was 15 i.e., 1500/100. To select the first house, simple random sampling was done by selecting a number between 1 to 15 and then by adding 15 to the next house. So every 15th house was taken till 100 houses were covered in each ward. In the wards having average of 2000 houses the sample interval was calculated as 20. To select the first house, simple random sampling was done by selecting a number between 1 to 20 and then by adding 20 to the next house. So every 20th house was taken till 100 houses were covered in each ward. If the house which was selected was locked even after three visits, the next house was considered for the study. Door numbers which were put during census survey 2011 was used for identifying the houses.

Definitions and measurements used in study

Measurement of blood pressure: Blood pressure readings were taken by single observer for every individual with same sphygmomanometer throughout the study. After taking informed consent from participants total two readings were per-

formed on each participant at 15 minutes interval in sitting position. Mean of two readings of systolic blood pressure (SBP) and diastolic blood pressure (DBP) are considered as representing blood pressure of participants. When SBP and DBP fall into different categories, the higher category was selected to classify individual's blood pressure. The readings are made of the close 2mm of Hg. mark on the scale.

Case definition of hypertension: Prehypertension is considered according to JNC VII criteria¹³ as SBP between 120-139 mm Hg and / or , DBP of 80-89 mm Hg.

Statistical analysis: Chi-square test has been used to test the significance of prevalence of prehypertension in association with various socio demographic factors. The odds ratio has been used to find the strength of relationship of various factors associated between pre-hypertensive and normotensive. 't-test', has been applied to compare means of study variables. Statistical software namely epi info version 22 was used for analysis of the data. Microsoft excel was used for data entry.

RESULTS

The study consisted of participants who were >30 years of age. Mean age of the population was 46.78 (SD 9.38). Male population constituted 202 (51.9%) and female constituted 187 (48.1%).

Table 1: Baseline characteristics among normotensive and prehypertensive subjects

| Characteristics | Normotensive (N=173) (%) | Prehypertensive (N=131) (%) | P* |
|--|--------------------------|-----------------------------|---------|
| Age Group (Years) | | | |
| 31- 40 | 60 (34.7) | 54 (41.2) | 0.006** |
| 41 - 50 | 64 (37) | 53 (40.5) | |
| 51 - 60 | 34 (19.7) | 24 (18.3) | |
| 61 - 70 | 15 (8.7) | 0 | |
| Sex | | | |
| Male | 92 (53.2) | 62 (47.3) | 0.312 |
| Female | 81 (46.8) | 69 (52.7) | |
| Level of Education | | | |
| Not literate | 0 | 8 (6.1) | 0.004** |
| Primary | 23 (13.3) | 23 (17.6) | |
| Secondary | 45 (26.0) | 36 (27.5) | |
| PUC/Diploma | 56 (32.4) | 41 (31.3) | |
| Graduate | 49 (28.3) | 23 (17.6) | |
| Socio economic status[#] | | | |
| Class I | 0 | 1 (0.6) | 0.66 |
| Class II | 12 (9.2) | 18 (10.4) | |
| Class III | 47 (35.9) | 53 (30.6) | |
| Class IV | 44 (33.6) | 55 (31.8) | |
| Class V | 28 (21.4) | 46 (26.6) | |
| Type of family | | | |
| Nuclear | 115 (80.2) | 105 (80.2) | 0.008** |
| Joint | 58 (33.5) | 26 (19.8) | |
| Broken | | | |

*chi square test; **statistically significant; Figures in parenthesis indicate percentages [#]BG Prasad Classification²¹

Table 2: Distribution based on behavioural risk factors

| Factors | Normotensive (n=173) | Pre-hypertensive (n=131) | P* |
|--------------------------------|----------------------|--------------------------|----------|
| Extra table salt | | | |
| Absent | 96 (55.5) | 37 (20.6) | <0.001** |
| Present | 77 (44.5) | 104 (79.4) | |
| Diet | | | |
| Veg | 84 (48.6) | 46 (35.1) | 0.019** |
| Mixed | 89 (51.4) | 85 (64.9) | |
| Tobacco consumption | | | |
| Absent | 160 (92.5) | 105 (80.2) | 0.001** |
| Present | 13 (7.5) | 26 (19.8) | |
| Alcohol consumption | | | |
| Absent | 153 (89) | 102 (86.4) | 0.519 |
| Present | 19 (11) | 16 (13.6) | |
| Stress | | | |
| Absent | 137 (79.2) | 90 (68.7) | 0.037** |
| Present | 36 (20.8) | 41 (31.3) | |
| Family h/o hypertension | | | |
| Absent | 167 (96.5) | 87 (66.4) | <0.001** |
| Present | 6(3.5) | 44 (33.6) | |
| Past h/o diabetes | | | |
| Absent | 165 (95.4) | 99 (75.6) | <0.001** |
| Present | 8 (4.6) | 32 (24.4) | |

*chi square test; **statistically significant; Figures in parenthesis indicate percentages

Among 389 subjects, 173 (44.5%) subjects were normotensive & 85(21.9%) subjects were hypertensive. The prevalence of prehypertension was found to be 33.7% (table I). The mean systolic and diastolic blood pressure among pre-hypertensive were 130.73 (SD 5.52) & 81.89 (SD 4.21) mm of Hg respectively. Whereas among normotensive, the

mean systolic and diastolic blood pressure was 113.36 (SD 3.87) & 73.17 (SD 3.39) mm of Hg respectively. The difference in the prevalence of prehypertension among males (40.3%) and females (46%) was not statistically significant (p=0.312). Prevalence of prehypertension among the individuals in the age category 31-40 years found to be higher (47.4%) when compared to other age categories.

Various baseline characteristics when compared between normotensive and pre-hypertensive (table 1) showed statistically significant association. The type of occupation among study participants had statistically significant association on the prevalence of prehypertension (p<0.001). Highest prevalence was seen among the individuals belonging division 10 of national occupational classification i.e., individuals reporting Occupations Unidentifiable or inadequately, individuals not reporting any Occupations.

Pre-hypertensive subjects had increased body mass index and higher prevalence of diabetes compared to normotensive. As compared to normotensive subjects, being overweight/obese increased odds of pre-hypertension (OR 2.2, P<0.001).Risk factors were analysed with respect to the presence of normotension and prehypertension.

Variousbehavioural risk factors such as extra salt intake, alcohol consumption, family history of hypertension, historyof diabetes mellitus were found to have significant association [table 2 and 3].

Table 3: Comparison of means of behavioural risk factors

| Factors | Normotensive Mean (SD) | Pre-hypertensive Mean (SD) | P* value | 95% CI# | |
|---------------------------------|------------------------|----------------------------|----------|---------|--------|
| | | | | Lower | Upper |
| Grams of Salt intake/day | 6.241(2.09) | 7.863 (2.48) | <0.001** | -2.139 | -1.105 |
| Number of times smoked/day | 4.54 (1.76) | 6.23 (2.86) | 0.059 | -3.452 | 0.067 |
| Duration of tobacco consumption | 10.08 (4.153) | 11.58 (4.32) | 0.308 | -4.44 | 1.44 |
| Duration of alcohol intake | 4.95 (1.224) | 8.88 (3.689) | <0.001** | -5.755 | -2.115 |
| BMI | 22.2 (2.209) | 24.78 (3.65) | <0.001** | -3.252 | -1.920 |

* Independent-t test, **statistically significant, #CI- confidence Interval of odd's ratio

Table 4: Multiple linear regression analysis of pre-hypertension with risk factors

| Variables | P* value | 95% CI# |
|---------------------------------|----------|-----------------|
| Systolic blood pressure | | |
| Age | 0.271 | -0.344 - 0.1 |
| Duration of alcohol consumption | 0.007** | 0.276 - 1.587 |
| Salt intake per day | <0.001** | 1.229 - 3.201 |
| BMI | <0.001** | 0.879 - 2.08 |
| Family h/o hypertension | <0.001** | -11.78 - -6.20 |
| Diastolic blood pressure | | |
| Age | 0.386 | -0.271 - 0.108 |
| Duration of alcohol consumption | 0.009** | 0.2 - 1.317 |
| Salt intake per day | 0.114 | -0.171 - 1.51 |
| BMI | 0.07 | -0.43 - 0.981 |
| Family h/o hypertension | <0.001** | -5.377 - -1.877 |

*multiple linear regression, **statistically significant, #CI- confidence Interval of odd's ratio.

Multiple linear regression analysis was applied to various risk factors. Risk factors such as age, amount of alcohol consumption, amount of salt intake showed significant association with the both SBP and DBP [table 4]

DISCUSSION

Our study documents a high prevalence of pre-hypertension in an urban population of south Indian community. Pre-hypertension are likely to be important contributors to the epidemic of cardiovascular disease and other complications of hypertension in future. In a study done in rural area of Andhra Pradesh¹⁴ demonstrated the prevalence of prehypertension to be 30.1%. In a study among the urban population of North India⁷ demonstrated the prevalence of hypertension to be 31%. A study in rural population in Assam¹⁵ demonstrated the prevalence to be 54%. Few other studies have demonstrated the prevalence of prehypertension to be >40%^{16,17}. Current study showed the prevalence of prehypertension to be 33.7%.

Data from NHANES II from United States revealed that 90% of individuals with prehypertension had one or the other cardiovascular risk factor.¹⁸ Studies from India have also indicated that increasing age, BMI, waist hip ratio, and impaired glucose tolerance/diabetes were independent risk factors for hypertension and prehypertension^{16, 17}. Similarly in our study most of the individuals with prehypertension had one or the other risk factor such as extra salt intake, overweight, alcohol consumption, and others.

Prevalence of prehypertension was high among the individuals in the age group of 31-40 years when compared to older age groups. It is likely that this trend is a result of progression of subjects with prehypertension to hypertension. Similar observations were made during the analysis of the NHANES III data set.¹⁹

Similar to other studies pre-hypertensive subjects had increased salt intake. It is well-recognized that higher salt intake is associated with higher blood pressure and reduction in salt intake lowers blood pressure. Inter salt study²⁰ demonstrated that systolic blood pressure can be reduced to the extent of 1-6 mm of Hg if salt is restricted to 100 mmol/day. Same holds good for the diastolic blood pressure where reduction is in the range of 0.03 to 2.5 mm of Hg.

On regression analysis duration of alcohol consumption, BMI, salt intake per day, contributed independently to prehypertension. Family history of hypertension was also an important contributor for prehypertension.

Limitations of the study

Firstly blood pressure measurements were taken on a single day and did not repeated again for practical reasons. Hence, we may have over - estimated pre-hypertension. Secondly various other factors such as socioeconomic status, knowledge attitude practice regarding hypertension and biochemical markers such as triglyceride, high-density lipoprotein, hyperuricemia are not evaluated which are known to influence hypertensive status. Thirdly, extrapolation of the prevalence of prehypertension determined from this small sample size to entire urban population remains a query

CONCLUSION

Our study highlights the increasing prevalence of prehypertension. The study gives important information regarding various risk factors associated with prehypertension. Simple lifestyle modifications such as low intake of salt, reducing alcohol can reduce overall blood pressure. Education regarding lifestyle and dietary practices at individual and family level is needed to bring about effective changes.

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