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Research Article

EVALUATION OF PRE-HYPERTENSION, HYPERTENSION AND ITS ASSOCIATED FACTORS AMONG IST YEAR MEDICAL STUDENTS

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ABSTRACT

Background and Objectives: Pre-hypertension is associated with increased progression to hypertension and cardiovascular risk. The objective of this study is to evaluate the prevalence of pre-hypertension and hypertension, as well as the associated factors among Ist year medical students who are from a similar socioeconomic status, dietary habits and lifestyle.

Materials and Methods: This was a cross-sectional study conducted among 137 Ist year medical students using digital blood pressure (BP) monitor on three different occasions and the average was taken and also a questionnaire was obtained to assess the associated factors and other demographic details. Data were analyzed with the use of SPSS software and results were demonstrated using descriptive tables where Chi-square test and one-way analysis was used.

Result: The prevalence of elevated BP (pre-hypertension and hypertension) as per JNC 7 criteria, among the medical students was 46.7%. There was a significant association of pre-hypertension with the individual risk factor like the family history of diabetes mellitus, diet and stress.

Conclusion: The study shows a significant proportion of individuals with elevated BP at a younger age, associated with risk factors such as family history of diabetes, diet and stress. Elevated BP increases the risk for the development of hypertension during adolescence. Hypertension being a disease of iceberg goes unnoticed leading to chronic disease, therefore identification at the earliest can curb the disease.

Keywords: Pre-hypertension, Adolescents, Prevalence, Hypertension.

INTRODUCTION

Pre-hypertension is a significant risk for progression of hypertension thereby increasing the risk for cardiovascular (CV) diseases and cerebrovascular events [1-4]. It is defined as individuals with blood pressure (BP) above optimal levels, but not clinical hypertension, i.e., systolic BP (SBP) 120-139 mmHg or diastolic BP (DBP) of 80-89 mmHg. Individuals with pre-hypertension have a greater risk of developing hypertension later in their life [5]. Framingham states that pre-hypertension is strongly associated with an increased risk of myocardial infarction and coronary artery diseases [6]. The mortality rate has been shown to be 50% higher in the prehypertensive adult compared to normotensive counterparts. Further, the death rate in India is increasing every year due to CV diseases. There is a lack of information about the prevalence and risk factor for pre-hypertension among adolescents in India. Lifestyle modification such as physical inactivity increased consumption of diets rich in fat, sugar and calories among adolescents could have changed the body metabolism, triggering a change in their BP [7]. Early identification of pre-hypertension plays an important role in screening for metabolic syndrome and prevention of CV accident. This study aimed to identify the prevalence of pre-hypertension, hypertension and associated factors among adolescent medical students who are from similar socioeconomic status, dietary habits, and lifestyle.

MATERIALS AND METHODS

This was a cross-sectional study conducted among the Ist year medical students of 2012 batch in SRM Medical College Hospital and Research Center. A total of 150 1st year medical students were taken in the age group between 17 and 18 years. Informed consent was obtained from the student before the study. Questionnaires regarding social, economic status, family history, diet history, knowledge and attitude toward the causes and preventive measures regarding hypertension were given, and filled questionnaires were obtained from the subjects. Of the 150 students, 13 students were excluded because of the incompletely filled questionnaires.

Anthropometric measures like height in meters and weight in kilograms has been measured, and the body mass index (BMI) was calculated. Waist circumference and hip circumference were measured by inch tape and waist-hip ratio was determined. BP readings were then obtained by LIPIKIND digital BP monitor. Studies suggest that, oscillatory method had been used to measure BP on a large screening basis. In our study, BP was screened using digital BP instrument in order to avoid errors due to a noisy environment and further it is easy to measure and can be repeated without any difficulty.

BP measurements were recorded in the sitting posture after 5 minutes of rest. Three readings were taken at each sitting on three different days, and the average was considered. The pulse rate was also noted. BP was then classified according to the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High BP (JNC 7) criteria as follows: Normal <120 mmHg systolic and <80 mmHg diastolic; pre-hypertension: 120-139 mmHg systolic or 80-89 mmHg diastolic; hypertension: ≥140 mmHg systolic or ≥90 mmHg diastolic [8] and the individuals were categorized as normotensives, pre-hypertensives, and hypertensive mentioned in Table 1.

Statistical analysis was performed by IBM SPSS software version 21. Data were presented as the mean±standard deviation. The one-way analysis of variance was used for comparison of continuous variables. Pearson Chi-square test, Likelihood ratio and linear by linear association were carried out to find out the association between BP and other associated factors such as family history of hypertension, family history of diabetes mellitus (DM), family history of coronary artery diseases, diet and anthropometric measurement. The level of significance was set at p<0.05. The study protocol was approved by the ethical committee of our institution.

RESULT

Around 137 subjects were enrolled in this study. Among them, 66 were males, and 71 were females. The mean age of the participant's was 18.18±0.61 years. Among this study population 70 were normotensive, 51 were pre-hypertensive and 13 were hypertensive.

Table 2 shows that the mean SBP among the normotensive, pre-hypertensive and hypertensive group were 110.82±5.4, 125.24±6.27 and 130.62±14.3 respectively, and the mean DBP among the normotensive, pre-hypertensive and hypertensive group were 69.59±7.46, 82.31±6.5, and 90.38±10.5, respectively. The differences were statistically significant (p<0.001). The mean body weight and height among the normotensive was 62.48±11.4 kg, 162.16±9.117 cm, pre-hypertensive was 71.96±13.8 kg, 171.25±9.475 cm and hypertensive was 69.75±20.63 kg, 163.81±8.640 cm respectively and this difference was also found to be statistically significant.

Based on the analysis Table 3 shows that 59.1% (39) of males and 16.9% (12) of females were found to be pre-hypertensive, and 6.1% (4) of males and 12.7 (9)% of females were found to be hypertensive, which was statistically significant.

Tables 4 and 5 shows that there was a significant association of pre-hypertension with the individual risk factor like the family history of DM, type of diet, stress. Also, other associated risk factors such as physical inactivity, duration of time spent on TV/computer, salt intake, showed a higher incidence rate among the pre-hypertensive group when compared to normal, but it was not statistical significant. No association was found between pre-hypertension and distribution of family history of hypertension, stroke, and coronary artery diseases. Also, no significant association was found between pre-hypertension and BMI, waist-hip ratio, knowledge about the hypertension. In our study, the students gave no history of smoking, alcohol intake and oral contraceptive pills.

DISCUSSION

Pre-hypertension, a new category published by the recent JNC-7 report says that even normal BP, SBP 120-129 mmHg or DBP 80-89 mmHg is considered as the potential risk of Hypertension and CV diseases [9]. According to the Framingham heart study, pre-hypertensive individuals have 2 times higher risk of progression to hypertension than normotensive people. Increased baseline BP leads to increase the rate of development of hypertension [10,11] which is proved by many longitudinal studies. The prevalence of pre-hypertension among our study population was similar to that of other studies [12,13]. In our study, the percentage of pre-hypertension (37.2%) and hypertension (9.5%) is 46.7%. Hypertension develops at a faster rate in adults with BP in the pre-hypertensive range than adults with optimal BP [14]. Also, studies suggest that the progression of pre-hypertension to hypertension was 7% per year. Redwine and Daniels. [15] predicted that progression to hypertension is 4 times higher in pre-hypertension than that of students with normal BP. Among the pre-hypertensive group, 59.1% of male and 16.9% of female had pre-hypertension that showed that there was a strong association for developing hypertension among males when compared to females. In our study, the prevalence of hypertension was higher among females.

We have also found that the subjects with pre-hypertension had a strong family history of diabetes, and it is statistically significant (p=0.001). Also, Marty's player showed that the pre-hypertension is associated with higher insulin resistance, which may confer additional CV risk. Furthermore, some studies have reported that DM is an independent risk factor for hypertension and that the baseline fasting serum glucose level has been associated with the progression to hypertension in men and women [16,17].

Thus, our data suggests that the familial history of DM should be viewed as an independent risk factor for the development of pre-hypertension. Prehypertensive individuals have higher Indian Diabetic Risk Score which is risk factor for both CV diseases and metabolic diseases. The contribution of metabolic syndrome components to CV and all-cause mortality was mainly related to BP and glucose abnormalities [18].

Also, studies have shown that prehypertensive individuals have increased thickness of tunica intima of the artery that is equivalent to the changes observed in hypertensive individuals. This suggests that even a slight elevation in BP causes changes in the arterial wall that predisposes the subject to CV risk [19,20]. Further studies suggest that youth with BP in the pre-hypertensive range have a vascular resistance equal to healthy individuals at least 20 years older than their chronological age. Since BP levels are simply a biomarker of the diseases process, it should be monitored from the adolescent period itself.

First year medical students undergo more stress during their learning period, which is proven by many studies with a prevalence rate of about 30-50% [21-26]. Numerous studies have revealed that persistent stressful conditions are associated with mental and physical health problems in medical students at various stages of their training [21-26]. Further excessive stress is known to be associated with lowered self-esteem [27,28], anxiety and depression [29,30], difficulties in solving interpersonal conflicts [31], sleeping disorders [32,33], increased alcohol and drug consumption [34,35], cynicism, decreased attention, reduced concentration and academic dishonesty [36]. Thus, the students are more prone for stress induced pre-hypertension and hypertension.

In our study, students who eat more of non-vegetarian diet than a vegetarian diet had pre-hypertension and hypertension which was statistically significant. Therefore, it can be concluded that dietary modification might have a significant role in controlling hypertension as proved in a study done by Koley et al. [37]. Further irregular exercises

Table 1: Classification of BP based on JNC 7

BP status	SBP (mmHg)	DBP (mmHg)
Normal	<120	<80
Pre-hypertension	121-139	81-89
Hypertension Stage I	140-159	90-99
Hypertension Stage II	160 or above	100 or above

SBP: Systolic blood pressure, DBP: Diastolic blood pressure, BP: Blood pressure

Table 2: Comparison of demographic and anthropometric parameters in normotensive, pre-hypertensive and hypertensive subjects

Parameter	Normotensive (n=73)	Pre-hypertensive (n=51)	Hypertensive (n=13)
Age (year)	18.11±0.356	18.26±0.856 Ns	18.23±0.599 Ns
Weight (kg)	62.48±11.461	71.96±13.855***	69.75±20.633 Ns
Height (cm)	162.16±9.117	171.25±9.475***	163.81±8.640 Ns
Systolic BP (mmHg)	110.82±5.442	125.24±6.279***	130.62±14.3 ***
Diastolic BP (mmHg)	69.59±7.461	82.31±6.528***	90.38±10.524***
Body mass index (kg/m^2)	23.935±4.3173	24.743±4.3533 Ns	25.622±6.1000 Ns
Waist-hip ratio	0.8795±0.16591	0.8620±0.11572 Ns	0.8523±0.14137 Ns

Values are shown as mean±SD. p value calculated using ANOVA, ***p<0.05 - Significant, Ns - Not significant. SD: Standard deviation

Table 3: Distribution of cases according to gender

BP status	Number of cases		p value
	Males (%)	Females (%)	
Normotensive	23 (34.8)	50 (70.4)	<0.001***
Pre-hypertensive	39 (59.1)	12 (16.9)	
Hypertensive	4 (6.1)	9 (12.7)	
Total	66 (100)	71 (100)	

p value was analyzed by Chi square test, ***p<0.001 statistically significant.
BP: Blood pressure

Table 4: Distribution of cases according to family history of DM

Family history of DM	Normotensive (%)	Pre-hypertensive (%)	Hypertensive (%)	p value
Yes (65)	29 (39.72)	27 (41.5)	9 (13.8)	<0.001***
No (72)	44 (60.27)	24 (33.3)	4 (5.6)	

p value was analyzed by Chi square test, ***p<0.05 - Statistically significant.
DM: Diabetes mellitus

Table 5: Distribution of pre-hypertensive cases according to diet

Diet	Normotensive (%)	Pre-hypertensive and hypertensive (%)	p value
Mixed (117)	66 (56.4)	51 (44.6)	0.009*
Vegetarian (19)	11 (57.9)	8 (42.1)	

p value was analyzed by Chi square test, *p<0.05 statistically significant

and spending more times on TV and computer thereby leading a more sedentary lifestyle might have also shown to have an increased prevalence of pre-hypertension and hypertension in Ist year students but this is not statistically significant. Also, our study did not find any significant relationship between BP measurement and other factors such as family history of hypertension, coronary arterial diseases, stroke, BMI, waist-hip ratio. However, data from other studies have shown an association between these factors [13,38].

Limitation

Our study has certain limitation like, homogenous sample and smaller sample size. Also, a follow-up study of the pre-hypertensive adolescents would give more qualitative assessment of progression to hypertension.

CONCLUSION

Pre-hypertension remains as a more prevalent and undetected health problem among adolescents in our community. Elevated BP increases the risk for the development of hypertension in the near future. Further, it complicates the body metabolism which may result in metabolic syndrome in adolescents. In our study, prehypertensive individuals had a family history of diabetes and mixed diet pattern. Thus, specific health intervention like early lifestyle modifications, weight control and physical activity should be advocated to prevent further progression of pre-hypertension to hypertension, thereby reducing the risk of CV morbidity and mortality.

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