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Original Article

Physiology Section

Hypertension in Asymptomatic, Young Medical Students with Parental History of Hypertension

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ABSTRACT

Introduction: Family history of hypertension in medical students is an important, non-modifiable risk factor for Hypertension (HTN) in future.

Aim: To determine the prevalence of sustained hypertension in young asymptomatic medical students with a parental history of hypertension.

Materials and Methods: A cross-sectional study was conducted in a medical college of Dehradun. A total of 104 medical students with parental history of hypertension (Group A) and 100 medical students without a parental history of hypertension (Group B) were included. Electronically blood pressures were recorded on two separate occasions at an interval of 15 days. Comparison was done using Chi-square test/Likelihood ratio, Un-paired t-test and ANCOVA.

Results: Overall, Group A had significantly higher percentage of prehypertensive (56.7%) and hypertensive (17.3%) students as compared to Group B which were 19% and 1%, respectively. Group A students had significantly higher Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DBP) as compared to Group B, even after controlling for the differences in Body Mass Index (BMI) and gender ($p<0.001$).

Conclusion: Hypertension was significantly higher in asymptomatic, healthy medical students with parental history of hypertension as compared to those with normotensive parents. We need to orient medical students to improve their knowledge, attitude and lifestyle practices early in life to prevent, treat hypertension and prevent its subsequent morbidity and mortality.

Keywords: Future risk, Medical undergraduates, Raised resting blood pressure

INTRODUCTION

Hypertension was one of the three most important risk factors for global disease burden in 2010 [1]. In India, about 1/3rd of the urban population and 1/4th of the rural population are hypertensive and most of them are unaware of their hypertension [2]. Reports state that 57% of all stroke deaths and 24% of all coronary heart disease related death in India are directly related to hypertension [3].

Although, hypertension is more prevalent in older populations, young adults (including the active young athletes) are not free from the disease [4]. Special attention must be given to the young adult hypertension as in most of the cases, it remains undiagnosed and needs early treatment [5]. Epidemiological data from India reported that approximately 12.7% hypertensive population [6] with varying prevalence of hypertension with vascular disease occurred below 40 years of age [7].

Presence of family history of hypertension in medical students is an important non-modifiable risk factor for hypertension in future since about 30% of the Blood Pressure (BP) variance can be attributed to genetic factors [8-11], and was found to vary from 25% in pedigree studies to 65% in twin studies. Hence, screening young adults with parental history of hypertension can lead to early detection of hypertension and treatment before possible end-organ damage. In our study, we aim to determine the prevalence of sustained hypertension in young asymptomatic adults with parental history of hypertension.

MATERIALS AND METHODS

This cross-sectional study was carried out in the Department of Physiology, Himalayan Institute of Medical Sciences (HIMS), Dehradun, from 21st July 2016 to 21st September 2016. The study was approved by the Institutional Ethical Committee.

A total of 104 healthy asymptomatic, medical students between 18-22 years of age (42 males and 62 females), who had a family history (mother and/or father) of HTN were chosen as cases (Group A). Another 100 healthy, asymptomatic age-matched medical students (39 males and 61 females), without a family history of hypertension were taken as controls (Group B). Exclusion criteria for both groups were:

a) students with a history of known medical or surgical disorders,

b) history of corticosteroid usage in the past year,

c) history of antidepressant medication usage.

A preformed questionnaire was given to the subject before inclusion into the study. The preformed questionnaire included medical history of his/her parents mainly focusing on hypertension and cardiovascular disease (CVD) events. The subjects were enrolled after obtaining an informed written consent. Height (HT) and body weight (BW) were measured for all subjects. BMI was calculated as BW in kg divided by square root of HT in meter.

Blood pressure and heart rate (HR) were measured once a day using an electronic sphygmomanometer (LotFancy FDA Approved Digital Upper Arm Blood Pressure Monitor and Heart Rate Monitor: Medium and Large Cuffs). Blood pressure was measured in the sitting position, after a minimum five minutes of rest. The readings were taken from both right and left arms of the subject. The higher BP reading was taken as the reference.

First reading (Day 0): One reading was taken at baseline and another reading was taken after one minute. An average of the two BP readings was calculated and recorded to represent the patient's blood pressure (SBP-1 and DBP-1) on day 0. Similarly, an average of two readings of heart rate was also taken (HR-1).

Second reading (15th day): After 15 days, the same procedure was followed to record the blood pressure (SBP-2 and DBP-2) and heart rate (HR-2) from the same subject. All other precautions for BP recording were taken according to the guidelines [12-14].

An overall average BP reading was then calculated as the arithmetic mean of day 0 BP and day 15th BP readings. This value was used to classify the subject into normal or prehypertensive or hypertensive category, based on Joint National Committe (JNC) VII guidelines

which are as follows [15-16]:

- Hypertensive: SBP ≥140 or DBP ≥90 mmHg
- Prehypertensive: SBP is 120-139 mmHg or DBP 80-89 mmHg.
- Normal: SBP <120 and DBP <80 mmHg.

STATISTICAL ANALYSIS

Data were presented in Mean±Standard Deviation (SD). Frequency of normotensives, prehypertensives and hypertensives were determined. Comparison of frequencies between the two groups as per gender were done using Pearson's Chi-square test or Likelihood ratio, if >20% of the expected counts are <5. Subsequent Post-Hoc testing was done as described earlier with Bonferroni adjusted p-value [17-19]. The comparison of frequency of various BMI classes was also done using Pearson Chi-Square test. An Un-paired t-test was used for comparison of selected parameters between the study groups. Subsequently, one-way ANCOVA (analysis of covariance) was used for the comparison after controlling for the differences in BMI and gender. For all the analyses, statistical significance was chosen at p-value (2-tailed) of <0.05, except for the Post-Hoc testing in the Pearson's Chi-square analysis, where the p-value (2-tailed) was set at <0.0083. Statistical Package for Social Science (SPSS) version 19 was used.

RESULTS

The frequency distribution of normotensives, prehypertensives and hypertensives among the studied subjects is shown in [Table/Fig-1]. Of all the studied subjects, the percentages of prehypertensives and hypertensives were 38.2% (male: 48.1% and female: 31.7%) and 9.3% (male: 17.3% and female: 4.1%) respectively [Table/Fig-1].

Out of all the students with positive parental history of HTN (Group A), 17.3% and 56.7% were hypertensive and prehypertensive respectively, which were statistically significant (p<0.001) [Table/Fig-2]. On gender-wise analysis, in Group A, 31.0% of the male and 53.2% of the female students were hypertensive and prehypertensive respectively [Table/Fig-2]. They were statistically significant (p<0.001). Maximum of the students (statistically significant: 80% overall; 64.1% among males and 90.2% among females) with negative parental history of HTN (Group B) had normal BP [Table/Fig-2].

BP Classification	Gender	Frequency (%)
Normotensive	Males (n=81)	28 (34.6%)
	Females (n=123)	79 (64.2%)
	Total (n=204)	107 (52.5%)
Prehypertensive	Males (n=81)	39 (48.1%)
	Females (n=123)	39 (31.7)
	Total (n=204)	78 (38.2%)
Hypertensive	Males (n=81)	14 (17.3%)
	Females (n=123)	5 (4.1%)
	Total (n=204)	19 (9.3%)

[Table/Fig-1]: Frequency distribution of normotensives, prehypertensives and hypertensives among the studied subjects.

The frequency distribution of underweight, normal, overweight and obese among the studied subjects is shown in [Table/Fig-3]. The classification was based on BMI [20-23].In our study, 22.5% (male: 23.5% and female: 22%) subjects with BMI ≥25 kg/m^2 and 12.3% (male: 9.9% and female: 13.8%) subjects with BMI ≥27.5 kg/m^2 were obese, whereas 17.6% (male: 27.2% and female: 11.4%) subjects with BMI 23 to <25 kg/m^2 and 27.9% (male: 40.7% and female: 19.5%) subjects with BMI 23 to <27.5 kg/m^2 were overweight [Table/Fig-3].

However, when the comparison of the frequency of different BMI classes was done between the two groups, they had statistically comparable or similar distribution [Table/Fig-4]. Although Group A students had significantly higher BMI as compared to that of Group B (p<0.001) when the analysis was done among the females and all the students as a whole [Table/Fig-5].

Subjects	Group	Blood Pressure Groups			χ2, df p-value
		Normo-tensive	Prehyper-tensive	Hyperten-sive	
Males (n=81)	A (n=42, 100%)	3 (7.1%)*	26 (61.9%)	13 (31.0%)*	31.84, 2 [<0.001]**
	B (n=39, 100%)	25 (64.1%)*	13 (33.3%)	1 (2.6%)*	
Females (n=123)	A (n=62, 100%)	24 (38.7%)*	33 (53.2%)*	5 (8.1%)	39.999, 2 [<0.001]**#
	B (n=61, 100%)	55 (90.2%)*	6 (9.8%)*	0 (0.0%)	
All combined (n=204)	A (n=104, 100%)	27 (26%)*	59 (56.7%)*	18 (17.3%)*	61.92, 2 [<0.001]**
	B (n=100, 100%)	80 (80%)*	19 (19%)*	1 (1%)*	

[Table/Fig-2]: Comparison of the frequency of normotensives, prehypertensives and hypertensives between the two groups as per gender.
*p-value≤0.0083: significant; **p-value≤0.01: highly significant. Pearson Chi-Square test. #Likelihood Ratio. χ^2= Chi-Square, df=degree of freedom. Group A= +ve family history of HTN, & Group B= -ve family history of HTN.

Classification	Gender	BMI	Frequency (%)	BMI	Frequency (%)
Underweight	Males (n=81)	<18.5kg/m2	7 (8.6%)	<18.5kg/m2	7 (8.6%)
	Females (n=123)		12 (9.8%)		12 (9.8%)
	Total (n=204)		19 (9.3%)		19 (9.3%)
Normal	Males (n=81)	18.5 to <23kg/m2	33 (40.7%)	18.5 to <23kg/m2	33 (40.7%)
	Females (n=123)		70 (56.9%)		70 (56.9%)
	Total (n=204)		103 (50.5%)		103 (50.5%)
Overweight	Males (n=81)	23 to <25kg/m2	22 (27.2%)	23 to <27.5kg/m2	33 (40.7%)
	Females (n=123)		14 (11.4%)		24 (19.5%)
	Total (n=204)		36 (17.6%)		57 (27.9%)
Obese	Males (n=81)	≥25kg/m2	19 (23.5%)	≥27.5kg/m2	8 (9.9%)
	Females (n=123)		27 (22.0%)		17 (13.8%)
	Total (n=204)		46 (22.5%)		25 (12.3%)

[Table/Fig-3]: Frequency distribution of underweight, normal, overweight and obese among the studied subjects.

Group A also had statistically higher SBP-1,2 and DBP-1,2 as compared to those of Group B. This was also true when analysis was done separately on each gender [Table/Fig-5]. These statistical significant differences between the two groups were even present when the differences in BMI and gender were controlled [Table/Fig-5]. This was not the case for HR-2, the difference of which between the two groups was significant among the females and when all the students were analyzed as a whole; but became non-significant when differences in BMI and gender were controlled [Table/Fig-5]. Both the

Group	BMI Classification-1				χ^2, df p-value
	<18.5 kg/m^2 (Under-weight)	18.5 to <23kg/m^2 (Normal)	23 to <25 kg/m^2 (Over-weight)	≥25 kg/ m^2 (Obese)	
A (n=104, 100%)	6 (5.8%)	50 (48.1%)	19 (18.3%)	29 (27.9%)	5.83, 3 [0.120]
B (n=100, 100%)	13 (13.0%)	53 (53.0%)	17 (17.0%)	17 (17.0%)	
Group	BMI Classification-2				χ^2, df p-value
	<18.5 kg/m^2 (Underweight)	18.5 to <23 kg/m^2 (Normal)	23 to <27.5 kg/m^2 (Overweight)	≥27.5 kg/m^2 (Obese)	
A (n=104, 100%)	6 (5.8%)	50 (48.1%)	30 (28.8%)	18 (17.3%)	7.59, 3 [0.055]
B (n=100, 100%)	13 (13.0%)	53 (53.0%)	27 (27.0%)	7 (7.0%)	

[Table/Fig-4]: Comparison of the frequency of different BMI classes between the two groups.
Pearson Chi-square test. χ^2= Chi-square, df=degree of freedom. Group A= +ve family history of HTN, and Group B= -ve family history of HTN.

and 17.6% were obese (BMI: ≥25 kg/m^2) and overweight (BMI: 23 to <25 kg/m^2) respectively [Table/Fig-3]. In a study conducted in Nepal on asymptomatic medical student 17-21 years of age has shown that 10.25% were hypertensive and 6.83% were prehypertensive [34]. In comparison, study conducted on Odisha medical students by Patnaik et al. showed prehypertensives were 64% and hypertensives were 3% among asymptomatic medical students [35]. In our study, 9.3% and 38.2% were prehypertensives and hypertensives respectively [Table/Fig-1].

Hypertension among medical students may be due to high levels of stress [36,37]. The tendency to eat more junk food among the students is also correlated to high systolic BP [34]. Higher percentage of hypertension among medical students with a family history of hypertension may be linked to genetic factors. Among the various mechanisms proposed to explain the relation between hypertension and a positive family history are genetic traits related to high blood pressure such as high sodium-lithium counter-transport, low urinary kallikrein excretion, elevated uric acid level, high fasting plasma insulin concentrations, Low Density Lipoprpotein (LDL) sub-fractions, higher BMI [38-40].

While screening young undergraduate medical students in our

Subjects	Group	Parameters (Mean±SD)								
		Age (years)	BW (kg)	BMI (kg/m^2)	SBP-1 (mmHg)	SBP-2 (mmHg)	DBP-1 (mmHg)	DBP-2 (mmHg)	HR-1 (bpm)	HR-2 (bpm)
Males (n=81)	A (n=42)	19.24±.93	70.15±14.09	23.49±5.65	133.74±12.21	131.90±10.54	80.88±9.93	79.80±9.49	85.95±11.23	84.17±10.27
	B (n=39)	19.26±.82	65.08±8.84	22.24±3.34	117.01±9.31	119.08±10.88	74.01±8.93	74.38±8.01	82.88±12.16	82.71±9.93
	p-value	0.926	0.058	0.235	<0.001**	<0.001**	0.002**	0.007**	0.241	0.518
	#p-value	–			<0.001**	<0.001**	0.003**	0.012*	0.276	0.551
Females (n=123)	A (n=62)	19.37±.85	62.95±13.22	23.35±4.21	120.27±11.45	120.39±13.49	77.40±8.91	76.44±8.86	86.43±9.27	88.21±9.87
	B (n=61)	19.10±.85	57.38±9.72	21.69±3.99	110.74±10.99	107.16±8.79	71.00±7.85	68.70±6.26	83.50±11.73	84.38±9.72
	p-value	0.079	0.009**	0.027*	<0.001**	<0.001**	<0.001**	<0.001**	0.127	0.032*
	#p-value	–			<0.001**	<0.001**	0.001**	<0.001**	0.354	0.128
All combined (n=204)	A (n=104)	19.32±.88	65.86±13.97	23.41±4.82	125.71±13.45	125.04±13.58	78.80±9.44	77.80±9.22	86.24±10.06	86.58±10.18
	B (n=100)	19.16±.84	60.38±10.08	21.91±3.74	113.19±10.77	111.81±11.24	72.18±8.37	70.92±7.49	83.26±11.84	83.73±9.79
	p-value	0.194	0.002**	0.014*	<0.001**	<0.001**	<0.001**	<0.001**	0.054	0.043*
	#^p-value	–			<0.001**	<0.001**	<0.001**	<0.001**	0.136	0.105

[Table/Fig-5]: Comparison of selected parameters between the two groups as per gender.
*p–value≤0.05: significant; **p–value≤0.01: highly significant. Unpaired t test. # One way ANCOVA: Covariate: BMI, and ^BMI and Gender. SD=Standard deviation. Group A= +ve family history of HTN and Group B= -ve family history of HTN.

groups had comparable or similar age and HR-1 [Table/Fig-5].

DISCUSSION

Prehypertensive adolescents and young adults are more prone to develop hypertension in later years of life [24]. Moreover, prehypertension in young adolescents is associated with other cardiovascular risk factors in the future [25]. So, if asymptomatic young adults with parental history of hypertension have a higher prevalence of prehypertension and hypertension than the control group, it may indicate that they are also more prone to adverse cardiovascular consequences in future. Hence, screening young adults with a parental history of hypertension would lead to early detection of hypertension and treatment before end organ damage occurs.

Our study recorded approximately 17.3% prevalence of hypertension and 56.7% prehypertension among undergraduate medical students whose parents have hypertension [Table/Fig-2]. This is significantly more than the prevalence rate of hypertension in students whose parents are normotensive.

Globally, numerous epidemiological studies reported that there is a high prevalence of obesity and hypertension among medical and university students in Scotland [26], United Arab Emirates [27], Nigeria [28], USA [29], Brazil [30], Colombia [31], Uganda [32], Ethiopia [33], and many parts of the world. In our study, 22.5% study, we had identified a significant number of individuals [38.2% (male: 48.1% and female: 31.7%)] in the prehypertension category, stressing the need to initiate screening strategies at an earlier age, so that major health gains can be made through the implementation of primary prevention strategies.

LIMITATION

Considering a single visit to ascertain hypertension status might lead to an overestimation of its prevalence. Extrapolation of our results to general population may not be possible as sample size is less and our study is only on medical students excluding general population.

CONCLUSION

The prevalence of hypertension in undergraduate medical students is much higher in those with hypertensive parents. Hypertension remains asymptomatic until complications like coronary artery disease, stroke, and renal failure develop. Undergraduate medical students are the future health care professionals of our nation, hence, it is very important to screen these students especially those with a genetic risk of hypertension in the form of positive family history. We need to devise educational programs on hypertension among this cohort of students, to improve their knowledge, attitude and lifestyle practices early in life to prevent and treat hypertension and its subsequent morbidity and mortality.

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