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Research Article

Prevalance of Pre Hypertension Amongst Medical Students in Eastern Odisha

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ABSTRACT

Aims & Objectives- To evaluate prevalence of prehypertension amongst medical students in eastern Odisha, and the impact of BMI on prehypertension with gender variation among adolescent . Study design : Cross sectional study was done by selecting clinically healthy 902 medical students (MBBS & BDS) , after written consent was obtained .Each participant's data was collected by questionnaire method followed by measurement of height ,weight ,waist –hip ratio & Blood Pressure .Students with confirmed hypertension were excluded from our study. Results : From a total of 936 students, 34 were excluded as per the the exclusion criteria.The final cohort included 400 girls & 502 boys. Normotensive participants were slightly younger than Pre HT subjects with p value <0.041, which was found to be statistically significant. BMI among male students was significantly raised in Pre HT cases when compared with normotensives. Similarly, the waist-hip ratio among pre hypertensive male and female students showed a significant rise with p<0.001 as compared to normotensive counterparts. Obesity status among normal and overweight students did not show any significant difference,while, 5.09% of overweight/ obesed students showed a rise in baseline BP(p<0.03), as compared to overweight/ obesed students with normal BP. There was a significant correlation between prehypertension and raised BMI with a p value < .000 among male students, but on the contrary, no significant correlation among the female students was observed. Conclusion- Despite the limitations of our study, we evaluated the risk for the development of HTN in adolescents with pre HT when compared with their normotensive counterpart. As the study population included adolescents from different demographic areas, hence these results are more likely to be applicable to other areas

Keywords: preypertension, adolescents, eastern Odisha, BMI

INTRODUCTION

Hypertension in adults, remains a major risk factor for stroke, myocardial infarction, vascular disease, and chronic renal disease. Estimates indicate, the number of hypertensives in India will nearly double from 118 million in 2000 to 213 million by 2025[1].The theory that the roots of essential hypertension may extend back to childhood,[2] is supported by several studies. Presently, with increasing affluence, obesity is reaching epidemicproportions[3] and in children and adolescents being one of the strongest predictors of young adulthood hypertension[4]. Obesity is associated with significant morbidity and mortality and in particular, it is an independent risk factor for cardiovascular disease (CVD), including hypertension, dyslipidemia, glucose intolerance, and impaired homeostasis[5]. Childhood blood pressure (BP) level and family history of hypertension, is important to determine whether the prevalence of hypertension is increasing or decreasing in children and adolescents. A recent study in a national sample has documented that, BP increased in children and adolescents since the late 1980[6].However, data on secular trends of BP in children and adolescents are scarce and inconsistent. Blood pressure readings gradually increased over time, which may initially be normal, then develops to prehypertension / high-normal, and then intermittently elevated, as seen in Long-term follow-up of patients destined to develop primary hypertension (formerly called "essential" hypertension) however, the readings may show considerable variability or lability[2]. As, originally proposed in The seventh report of the Joint National Committee (JNC 7) published in 2003, the following classification based on the average of two or more properly measured readings, at each of the two or more visits after an initial screening[2]; which was later supported by The eighth report of the JNC 8[7] and the American and International Societies of Hypertension (ASH/ISH). As, systolic BP <120 mmHg and diastolic BP<80 mmHg is considered to be normal. Prehypertension is defined as systolic BP120 to 139 mmHg **or** diastolic BP 80 to 89 mmHg. Trials on patients at higher risk in whom goal blood pressures below 140/90 mmHg may be associated with improved outcomes. There are not many studies reported from this part of the country which estimates the prevalence of prehypertension among medical students & hence this study was undertaken. Drug therapy for prehypertension is not recommended for

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various reasons[8,9]. Our study population consisted of students enrolled in a medical college who were from different socioeconomic status, dietary habits & lifestyle. Early identification of prehypertension in this subgroup plays an important role in screening for metabolic syndrome and identifies modifiable factors required for prevention of cardiovascular accidents.

Aims and objectives

1. Prevalance of prehypertension amongst medical students.
2. Examine impact of BMI on Prehypertension.

MATERIAL AND METHODS

Study population- Prior to enrollment in the study, written informed consent was obtained from subjects ≥18 years old or from guardians of subjects < 18 years, as per the guidelines established by the Institutional Review Board at IMS & SUM Hospital. Clinically healthy medical students (both MBBS & BDS), were included in our study. Students with known hypertension, known cardiovascular disease, on antihypertensive drugs or any cardiovascular drugs, were excluded from our study.

Data Collection: Each participant's data was collected by questionnaire method, (which includes age ,sex, family history, SES, and intake of medicines or suffering from CVDs) followed by anthropometric measurements, recording of Blood pressure (BP), Height & Weight was noted along with waist-hip ratio by trained personnel.

Calibrated measuring scale was used to measure height. Height was measured in the standing position wearing socks, the head in the Frankfort horizontal plane and heels together, at a 45 degree angle . Two height measurements were obtained, if the difference between the first two were more than 0.5 cm apart, a third reading was taken. Weight was measured using an electronic scale. The scale was calibrated every month and was used exclusively for this investigation. Two weight measurements were obtained, any difference in the first two reading by more than 0.3 kg, a third measurement was taken. Body mass index was calculated as kilograms per meter square. Waist measurement was done by measuring halfway between lowest rib and the top of hipbone, roughly in line with belly button. Hip measurement was done by wrapping the tape around the fullest part of hips and buttock.

Blood pressure was measured using a standardized protocol according to the Fourth Report on BP in Children .Trained personnel recorded BP using mercury sphygmomanometer. Participants were seated with feet resting flat on a surface and right arm resting at heart level. Basing on arm circumference, the appropriate cuff was selected and placed around the upper arm, two blood pressure recordings were measured with interval of one minute. The Blood Pressure was initially measured by palpatory method. The cuff was rapidly inflated to the maximum inflation level and deflated at a rate of 2 mmHg per second. As per the, standard protocol, SBP was determined by the onset of the "tap- ping" Korotkoff sounds (K1). the point at which the sound became muffled determined (K4); and the disappearance of the sound (K5) determined the DBP. Three blood pressure recordings were obtained. The mean systolic and diastolic blood pressure was calculated from the average of three blood pressure determinations .If any of the 3 readings varied by more than 10mmHg, a fourth reading was performed and included in the average. The mean of 2 resting measures was used. Subjects were classified as normotensive (NT = 737), pre-hypertensive (PreHT = 165) or, hypertensive – (5 students) as per their BP level according to the 4th Report of Cardiac and Vascular Consequences of Pre-Hypertension in Youth.

Statistical analysis

SPSS Version 20 was used for all data processing and analysis. The mean and standard deviation was calculated for height, weight, age, blood pressure and body mass index, as the measurement was normally distributed. Significant association between two variables were determined via two sample Student t-tests, which was used to calculate Karl Pearson's correlation coefficient , $p < 0.05$ was considered significant.

RESULTS AND DISCUSSION

A total of 936 student comprising of both boys & girls participated in the screening test. The final cross sectional study was based on sample of 902 participants as 34 students were excluded. Out of which 29 students were excluded due to inadequate follow up to determine baseline BP status and rest 5 students had confirmed HTN on both the occasions. The final cohort included 400 girls and 502 boys, all total 902 students participated in the study. Demographic data based on Age, Sex, base line BP, BMI and Waist –hip ratio was tabulated in Table-1.

The mean age for normotensive participants was 18.7±0.13 and those with pre HT was found to be 19.12±1.46. Normotensive participants were slightly younger than Pre HT subjects with p value <0.041, which was statistically significant. Out of total 502 males, 394 comprising of (78.4%) were found to be normotensive, while 108(21.5%) were found in the preHTN range. Similarly, (85.7%) of females were normotensive and pre-HTN was found in 57(14.2%) female students.

Anthropometric variables like BMI, Waist-hip ratio and obesity status were the co-variates considered, as It is essential to make a distinction between those at augmented risk as a result of abdominal obesity from those with generalized obesity[5], that interacts between abnormal BP and incident HTN. BMI among male students was significantly raised in Pre HT cases when compared with normotensives. Similarly, the waist-hip ratio among pre hypertensive male and female students showed a significant rise with $p<0.001$ as compared to normotensive counterparts. Obesity status among normal and overweight students did not show any significant difference .while, 5.09% of overweight/ obese students showed a rise in baseline BP($p<0.03$), as compared to overweight/ obese students with normal BP. There was a significant correlation between prehypertension and raised BMI with a p value less than .000 among male students (Table-II & III) ,but on the contrary, no significant correlation among the female students was found. (Table-IV & V).

Table 1: Characteristics

	Normal BP(n=737)	PreHTN(n=165)	P value
Age	18.7±0.13	19.12±1.46	<0.041
Sex (Male-502)	394(78.4%)	108(21.5%)	
(Female-400)	343(85.7%)	57(14.2%)	
BMI,kg/m^2 (Male-502)	22.57±0.14	24.63±0.31	NS
BMI,kg/m^2 (Female-400)	21.8±0.16	23.0±1.01	<0.001
Waist-hip ratio(Male -502)	0.87	0.93	<0.001
Waist-hip ratio (Female-400)	0.81	0.88	<0.001
Obesity status-Normal	697(77.2%)	36(3.9%)	NS
Over weight	34(3.7%)	83(9.2%)	NS
Overweight/obesed	6(0.66%)	46(5.09%)	<0.03

Table 2: Paired Sample t-test Statistics for prehypertension(for male students)

		Mean	SD	S.E of mean
1.	BMI	24.63±0.31	3.14175	0.104
	SBP	128.78	6.617	.220
2.	BMI	24.63±0.31	3.14175	0.104
	DBP	84.98	6.454	.214

Blood pressure pattern increases from birth to end of adolescent i.e from 70mmHg to 120 mmHg .This pattern continues into adolescence and adulthood; suggesting that their roots of essential hypertension have their origin early in life [9] .A familial influence on blood pressure often identified in early life. Multiple readings of blood pressure from the same day are considered appropriate for epidemiological studies [10]. The National Heart, Lung and Blood Institute suggests that people with prehypertension are at a higher risk for hypertension, as compared to people with normal blood pressure[11]. Identification of adolescents for elevated blood pressure at an early stage can prevent rate of progression of Cardio vascular consequences due to hypertension in adulthood [12]

Table 4: Paired Sample t-test Statistics for prehypertension (for female students)

		Mean	SD	S.E of mean
1.	BMI	23.0±1.01	10.147	0.104
	SBP	122.43±12.7	12.7	.220
2.	BMI	23.01±1.01	10.147	0.104
3.	DBP	80.02±98	9.08	.214

In our study 18.2% students fell in risk of prehypertension & associated factors. The contributing factors include familial, over weight & obesity with raised WHR . Among prehypertension (n=165, 18.2%), had both elevated systolic & diastolic BP which indicates higher risk than those with either increase in systolic or diastolic BP. Lifestyle related factors & other risk factors contributing for development of prehypertension, includes high salt intake, excessive calorie intake , low intake of fruits & vegetables, smoking , excessive alcohol consumption ,low physical activity & increased weight (general & abdominal)[13]. Current evidence suggest that for medical students stress is an additional factor for prehypertension. Dr Buch N et al of Surat in a cross-sectional study in India, reported prevalence rate of hypertension as 6.48% among 6-18 yrs. old school children[14]. Later study done in 2012 by Margaret Riley et al in Michigan, that combined prevalence of prehypertension and hypertension in adolescents who are obese is greater than 30 percent in boys and is 23 to 30 percent in girls[15]. This indicates that there is an increasing trend in prehypertension among adolescents. In our study, prevalence of prehypertension among males was

Table 3: Paired samples correlations(for male students)

	Correlation	Significance
Pair 1 BMI & SBP	.418	.000
Pair 2 BMI & DBP	.099	.326
Correlation (for male students)		
	BMI	SBP
BMI Pearson Correlation	1	.418
Sig (2 tailed)		.000
N	502	
SBP Pearson Correlation	.418	1
Sig (2 tailed)	.000	
N	502	
	BMI	DBP
BMI Pearson Correlation	1	.999
Sig (2 tailed)		.326
N	502	165
DBP Pearson Correlation	.999	1
Sig (2 tailed)	.326	
N	502	

Table 5: Paired samples correlations(for female students)

	Correlation	Significance
Pair 1 BMI & SBP	.390	.08
Pair 2 BMI & DBP	.328	.126
Correlation(for female students)		
	BMI	SBP
BMI Pearson Correlation	1	.390
Sig (2 tailed)		.08
N	400	400
SBP Pearson Correlation	.390	1
Sig (2 tailed)	.08	
N	400	
	BMI	DBP
BMI Pearson Correlation	1	.328
Sig (2 tailed)		.126
N	400	400
DBP Pearson Correlation	.328	1
Sig (2 tailed)	.126	
N	400	

found to be 21.5%, while 14.2% females had prehypertension. Our findings are similar, with a cross-sectional study done by Dr Avinash sharma et al[16] who reported prevalence of prehypertension among males was 16.2%,while 12.3% of girls had prehypertension. In contrast, a study done by Ujunwa, Fortune A. et al showed prevalence of prehypertension among males and females were 14.3% and 20.1% respectively[17] , where girls had elevated BP than the boys.

According to Sorof JM et al in adolescents relationship between BP & BMI are significant when statistical adjustment of adiposity is performed [18] . Recent investigators from different groups suggested obesity - independent relationship between BP & CV changes in some prehypertensive cases.[18,19].In our current study ,our observations provides the data that maximum number of cases of prehypertension were with increased BMI , but in contrast to it few students (3.9%) with normal weight also had Prehypertension .

In our study there was more prevalence of pre hypertension in obese adolescents as compared to non-obese (14.3% : 3.9%)& when compared it was statistically significant($p < 0.001$). The association between elevated BP & BMI observed by us has been supported by Mohan B et al & NK Anand [20].

The prevalence of prehypertension in our study population was 18.2% with male and female prevalence rates of 21.5% and 14.2%respectively. This difference in the observed prevalence of hypertension may be probably, due to a greater delay among boys in completing pubertal development and attaining final height than in females. In addition, greater Body mass Index and waist circumference noted in males may have contributed to this difference in blood pressure. Among the prehypertensives, there was a favourable outcome for girls ,which probably may be due to the protective action of estrogen. The observed prevalence rates shows an increase in the prevalence rate of hypertension when compared to a rate of 3.3% obtained in Southwest of Nigeria[21]

A Case control study done by Yusuf S [22] et al showed waist-hip ratio (>0.9 for men and >0.85 for women) , both are used for measures of central obesity. According to, Current Medical Research and Opinion[23] , a cohort study done by National Health and Nutrition Examination Survey (NHANES III) 15,000 people participated in this study, their waist circumference & BMI was measured . On comparison with BMI , increased waist circumference was associated with increased obesity related health risks .The outcome was more prone to be associated with CV risks , & the difference between the two was statistically significant. This suggests that WHR is superior than BMI as a variable in prehypertensive cases .

Our current data agrees with the above predictions that , male students with WHR ≥0.93 & female students WHR ≥ 0.88,were more prone to prehypertension ,and the difference was statistically significant .Central obesity is associated with a statistically higher risk of heart disease, hypertension, insulin resistance, and Diabetes Mellitus Type 2 [24] .With an increase in the waist to hip ratio and overall waist circumference the risk of death increases as well. [25]

CONCLUSION

With India emerging as an economically developed nation, the need of the hour is to focus research and data collection on urban as well as rural population. Studies targeting prehypertension would provide an estimate of the future magnitude of the problem and assist in developing strategies for control of hypertension and CVD. With growing urbanization, socioeconomic development and life style changes from traditional to modern have lead to physical inactivity. Rising affluence has also modified the dietary pattern characterized by increased consumption of diets rich in refined carbohydrates, fats, and increased calories. The all cause mortality has also been shown to be 50% higher in the prehypertensive adults compared to the normotensive counterparts.

Strength of our study was a large group of medical students from a similar age group. Limitation of this study was absence of follow-up.Despite the limitations of our study, we evaluated the risk for the development of HTN in adolescents with pre HT when compared with their normotensive counter part. As the study population included adolescents from different demographic areas, hence, these results are more likely to be applicable to other areas.

The published data may not reflect true prevalence as there are methodological issues with measurement of blood pressure and heterogeneity across studies in young people, but it appears that rates of hypertension are increasing in Low and middle income countries. Thus, large scale screening and awareness of hypertension will go a long way to improve the situation.

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