Research Article

Prevalence of prehypertension among medical students and its correlation with anthropometric indices

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ABSTRACT

Background: Hypertension is one of the leading causes of death and disability worldwide. Prehypertension acts as a warning sign, in younger age group which indicates the risk of developing hypertension in later life. Obesity is another important public health problem that has assumed epidemic proportions in developing countries and acts as a major independent risk factor for the development of hypertension. **Objectives:** The objective of the study was to identify the prevalence of prehypertension and its relation with body mass index (BMI) and neck circumference (NC) among young medical students. **Materials and Methods:** This descriptive cross-sectional was conducted among 192 medical students. The participants were examined for various anthropometric parameters such as height, weight, and NC. BMI was calculated. Blood pressure (BP) was recorded using a standard mercury sphygmomanometer. The correlation between BMI, NC, and BP was assessed by calculating the Pearson's correlation coefficient (r) and $P > 0.05$ was taken as statistically significant. **Results:** The overall prevalence of prehypertension among the participants was 21.35%. The prevalence was higher among the overweight medical students (45.48%). Mean BMI and mean NC were higher among prehypertensives compared to normotensives. A positive significant relation was found between BPs and both BMI and NC. **Conclusion:** Our study revealed a high prevalence of prehypertension among medical students which was significantly associated with BMI and NC.

KEY WORDS: Prehypertension; Body Mass Index; Obesity; Overweight; Neck Circumference

INTRODUCTION

Hypertension is one of the leading causes of death and disability worldwide which exerts a considerable burden on cardiovascular health status and health-care systems in countries like India.[1-3] In a worldwide data analysis for the global burden of hypertension in 2000, it was found that 20.6% of Indian men and 20.9% of Indian women were suffering from this disease and these rates are projected to go up to 22.9% and 23.6% for Indian men and women, respectively, by 2025.[3] Blood pressure (BP) levels in hypertension are related to the risk for coronary heart disease and stroke in a positive and progressive way.[4] The seventh joint national committee (JNC-VII) on prevention, detection, evaluation, and treatment of high BP has introduced prehypertension as a new category for classification of BP level, where systolic BP lies between 120 and 139 mmHg and/or diastolic BP between 80 and 89 mmHg.[5] This was done based on the evidence from the Framingham study[6] which revealed that in such individuals the chance of developing hypertension is higher than in those with a BP <120/80 mmHg (termed "normal" BP) at all ages. Hence, prehypertension acts as a warning sign, in younger age group which indicates the risk of developing hypertension in later life.[7] Its inception has made monitoring and intervention necessary in a large number of people who were earlier considered normal.[8] It has been shown by previously conducted studies that prehypertension is related to a 1.7-fold increase in coronary artery disease and a

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3.5-fold increase in myocardial infarction.[9] Prehypertension, therefore, necessitates daily life adjustments to prevent development to hypertension.[5]

Obesity is another important public health problem that has assumed epidemic proportions in developing countries as well.[10] Obesity is a major independent risk factor for the development of hypertension. There exists a lot of epidemiologic evidence that supports the association between obesity and high BP.[11-13] In obesity, the deposition of fat could be generalized or may occur preferentially in different adipose tissue compartments.[14] Of the various methods available to assess obesity, body mass index (BMI) is a better tool with a significant clinical utility.[15,16] The WHO defines overweight as BMI between 25 and 30 kg/m^2, and BMI >30 kg/m^2 is regarded as obesity.[17] It has also been demonstrated by several studies that upper body subcutaneous adipose tissue may confer added possibility for the development of metabolic risk factors beyond overall and central adiposity.[18] One such index for upper body subcutaneous adipose tissue distribution is neck circumference (NC) which has been associated with cardiometabolic risk across various ethnicities in the general population and thus can be used as a simple and time-saving measurement of obesity.[19-22]

Although many studies have focused on the relation between hypertension and obesity, comparatively little research has been conducted on BMI and NC in their associations with prehypertension in young adults. The purpose of this investigation is to identify the prevalence of prehypertension and its relation with BMI and NC among young medical students.

MATERIALS AND METHODS

This descriptive cross-sectional study was conducted in the Department of Physiology among the medical students of SKIMS Medical College, Srinagar, from January 2018 to June 2018. A total of 192 students in the age group of 18–22 years participated in the study. The students were informed about the objectives of the study and verbal consent was obtained from them. The study was approved by the institutional ethics committee. A detailed history was taken from each and physical examination was performed. The finding was recorded in the pro forma along with other particulars such as age, gender, residence, community, and family history of hypertension. Students having history of hypertension, any cardiac or renal disorders, smokers, those taking any cardioactive drug, or attending a recent weight loss program were excluded from the study.

The participants were examined for various anthropometric parameters such as height, weight, and NC. Weight was measured using digital scale to the nearest 0.1 kg with only light clothing, and for the determination of height, subjects were made to take off their shoes, stand upright with their head in the Frankfort plane with the heel, buttock, and occiput against the wall. Height was recorded to the nearest 0.5 cm. BMI was calculated as weight (in kgs) divided by the square of height (in meters) and was categorized according to the WHO classification. NC was measured midway between midcervical spine and midanterior neck, horizontally (just below the laryngeal prominence), using non-stretchable plastic tape. It was recorded in centimeters (cm) with the subject looking straight ahead, shoulders down and relaxed, but not hunched. Students with NC >37 cm for male and >34 cm for female were evaluated as overweight.[23]

BP was recorded using a standard mercury sphygmomanometer (Diamond deluxe). The students were seated calm and quiet for at least 5 min before measurement on comfortable chairs. BP was recorded in sitting position and the right arm. Three readings of BP were recorded with interval of 3 min between consecutive measurements. The average of the three readings was calculated and entered in the pro forma. All BP recordings were taken during afternoon hours and recorded by the same person and by the same instrument. BP was categorized as per JNC-VII classification.[5]

Data were collected and grouped using MS Excel. Descriptive data were represented by the percentage. The mean values and standard deviation of all anthropometric parameters were calculated. Data were entered into SPSS version 20.0. Binary logistic regression analysis was done. The correlation between BMI, NC, and BP was assessed by calculating the Pearson's correlation coefficient (r) and $P > 0.05$ was taken as statistically significant.

RESULTS

Among the 192 participants, 50% were male and 50% were female. The prevalence of overweight (according to BMI) was 12.5% and prevalence of overweight (according to NC) was 19.7%. None of the candidates fell in the obese or underweight category; hence, it was not included. Mean age of participants was 19.61 years [Table 1].

Table 1: Baseline descriptive characteristics of the participants

Variable	Subgroup	*n* (%)
Age	18–20	98 (51.04)
	20 and above	92 (47.91)
Gender	Male	96 (50.00)
	Female	96 (50.00)
BMI	Normal	168 (87.50)
	Overweight	24 (12.50)
Neck circumference	Normal	154 (80.20)
	Overweight	38 (19.79)

BMI: Body mass index

Table 2: Prevalence of prehypertension by age, gender, and family history of hypertension

Variable	Subgroup	Pre-hypertensive *n* (%)	Normotensive *n* (%)
Age	18–20	15 (15.30)	83 (84.46)
	20 and above	26 (27.65)	68 (72.34)
Gender	Male	24 (25.00)	72 (75.00)
	Female	17 (17.77)	79 (82.29)
Family history	Present	38 (23.75)	122 (76.25)
	Not present	3 (0.09)	29 (90.62)
Total prevalence		41 (21.35)	151 (78.64)

Table 3: Prevalence of prehypertension by BMI and NC

Variable	Subgroup	Prehypertensive *n* (%)	Normotensive *n* (%)
BMI	Normal	30 (17.85)	138 (82.14)
	Over weight	11 (45.83)	13 (54.16)
NC	Normal	28 (18.18)	126 (81.81)
	Over weight	13 (34.21)	25 (65.78)

BMI: Body mass index, NC: Neck circumference

Table 4: Mean BMI and NC in prehypertensives and normotensives

Variable	Mean±SD	
	Prehypertensives	Normotensives
BMI	23.07±3.00	21.42±2.41
NC	33.93±2.27	35.36±2.36

BMI: Body mass index, NC: Neck circumference, SD: Standard deviation

The overall prevalence of prehypertension among the participants was 21.35%. The prevalence among males was 25% and among females was 17.7%. The prevalence of prehypertension in those with family history of hypertension was 23.7% against 0.09% among those without a family history. The prevalence in younger age group (18–20) was 15.30% and in older age group (20 and above) was 27.65%. No participant was found to be hypertensive [Table 2].

The prevalence of prehypertension was higher among the overweight medical students (45.48%) as compared to for those who had normal BMI (17.85%). The prevalence of prehypertension was also higher among those having neck overweight/obesity (34.21%), as compared to for those with lower NC (18.18%) [Table 3].

Our study also revealed a higher mean BMI and mean NC among prehypertensives compared to normotensives [Table 4].

Pearson's correlation showed a positive significant relation between BP indices such as systolic BP (SBP), diastolic BP (DBP), and mean arterial pressure (MAP) with BMI. A positive significant relation was also found between BP indices such as SBP, DBP, and MAP with NC [Table 5].

Table 5: Correlation of BMI and NC with SBP, DBP, and MAP

Variable	BMI		NC	
	r	*P*	*r*	*P*
SBP	0.305**	>0.001	0.301**	>0.001
DBP	0.309**	>0.001	0.303**	>0.001
MAP	0.317**	>0.001	0.312**	>0.001

SBP: Systolic blood pressure in mmHg, DBP: Diastolic blood pressure in mmHg, MAP: Mean arterial pressure in mmHg, BMI: Body mass index, NC: Neck circumference. *P<0.05, **P<0.001

Table 6: Binary logistic regression analysis

Variable	OR	95% CI	*P*
BMI	1.204	(1.039–1.395)	0.013*
NC	1.203	(1.025–1.411)	0.023*

OR: Odds ratio, CI: Confidence interval. BMI: Body mass index, NC: Neck circumference. *P<0.05

In analysis, prehypertension was significantly associated with both BMI and NC. The risk of prehypertension was higher in overweight (odds ratio [OR]: 1.204; 95% confidence interval [CI]: 1.039–1.395, $P < 0.05$) and the risk of prehypertension increases with increase in NC (OR: 1.203, 95% CI: 1.025–1.411, $P < 0.05$), as shown in Table 6.

DISCUSSION

The overall prevalence of prehypertension among the participants of this study was 21.35%. The prevalence among males was 25% and among females was 17.7%. None of the students were found to be hypertensive. The prevalence in the present study is comparable to the prevalence reported from a study conducted in Puducherry among medical staff.[24] However, it is lower when compared to various other studies.[25-27] A possible reason for the lower prevalence of prehypertension in our study could be the lower prevalence of overweight among our students. Our study also showed a higher mean BMI and mean NC among prehypertensives compared to normotensives. This is in accordance with findings of a study conducted among medical students in South India.[27] We also found a significant association between BMI and BP, which is consistent with findings of

most other studies.[24-28] The current study revealed that the risk of prehypertension was higher in overweight. A significant association between NC and BP was also found and the risk of prehypertension increased with increase in NC. These observations are similar to those of a Turkish study.[28]

Prehypertension is a potentially modifiable risk factor preceding hypertension which can be reduced by simple lifestyle changes.[29] The present study stresses the need to identify, monitor, and counsel this subgroup of prehypertensives more aggressively to reduce this epidemic of hypertension and prevent its dreaded outcomes like cardiovascular accidents. There is a need to reduce the gap between knowledge and implementation of dietary and physical activities such as encouraging participation in sports and regular exercise and discouraging fast food consumption. Furthermore, medical students undergo a lot of psychological distress, especially during initial years of training which has been demonstrated by various studies.[30-32] This continued stress has been related to various mental and physical problems including stress-related eating which makes these students more prone to obesity and overweight.[33,34] This further brings out the importance of counseling sessions or talks on adaptive stress management for medical students. Introduction of changes in style of living with proper interventions would not only better the health-related variables (exercise, eating, stress, etc.) but may also prove to be productive in long-term control of blood pressure.

An important limitation of this study is that follow-up was not conducted. Another is the cross-sectional nature of the study design. Other limitations include not taking 24 hrs ambulatory BP measurements and not collecting data on salt intake, physical activity, lipid profile, or blood glucose level due to various constraints (financial and time).

CONCLUSION

Our study conducted among healthy medical students revealed a high prevalence of prehypertension which was significantly associated with BMI and NC. These results stress the need for routine blood pressure measurements and regular follow-ups, and also call for certain lifestyle modifications from a younger age to prevent development of hypertension later.

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