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Inter-Arm Blood Pressure Difference and Cardiovascular Disease Risk among Healthy Adults

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ABSTRACT-
BACKGROUND - *Most recommendations on BP measurement and hypertension have stated that BP should be measured in both arms This present study was conducted to assess the relation of interarm blood pressure difference with family history of hypertension.*
AIMS AND OBJECTIVE *–*
Primary objective was to find the association of raised IAD in BP with family history of hypertension, stroke, coronary artery disease, and peripheral vascular disease. The secondary objective was to find a correlation of raised IAD in BP with anthropometric parameters.
MATERIAL AND METHOD -
A cross-sectional study was carried out among 200 medical students. BP was measured twice in each arm, using mercury sphygmomanometer, and the values were averaged. IAD in BP is defined as the difference between average BP in the right arm and average BP in the left arm. Family history of hypertension, coronary artery disease (CAD), peripheral vascular disease, and stroke were obtained using questionnaire. Height and weight were measured using standard equipment.
RESULTS : *Raised IAD in BP shows a statistically significant association with family history of hypertension (P = 0.002).*
CONCLUSION : *The presence of raised IAD in BP in patients with family history of hypertension warrants follow-up of these patients for disease development in future.*
KEY WORDS: *Cardio Vascular Diseases; Inter-arm Difference in Blood Pressure; Mean Arterial Blood Pressure; Peripheral vascular disease*

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I. INTRODUCTION

Hypertension is a major health challenge affecting over 30% of adults worldwide and is the major risk factor for cardiovascular and cerebrovascular disease. Hence, accurate and comprehensive methods for diagnosing and monitoring hypertension are crucial to reduce this health burden. Clinical guidelines recommend that comprehensive screening for hypertension includes measuring arterial Blood Pressure (BP) in both arms at the initial visit. This recommendation arises from epidemiological studies showing interarm differences in brachial systolic BP of ≥10 mmHg are associated with increased risk of vascular disease, and differences ≥15 mmHg are linked to widespread vascular disease and increased mortality . Thus, identification of interarm BP (IABP) differences offers prognostic utility when screening for overall cardiovascular risk and may complement identification of a hypertensive phenotype.

Inter arm blood pressure difference (IABPD) may be recognized in various persons, from healthy pregnant women to patients with high CVD risk factors such as hypertension, diabetes and chronic kidney disease. The slight bilateral arm blood pressure difference may not be related to an unhealthy condition; however, a significant pressure difference between the 2 arms may be due to arterial stiffness or other arterial changes, results in decreased blood flow and adverse outcomes.

The National Institute for Health and Clinical Excellence recommends that IABPD ≤ 10mm Hg can be regarded as normal. Most of the previous studies considered IABPD ≥ 10 mm Hg as a cut-off for cardiovascular disease and mortality. The risk of cardiovascular mortality was elevated by 58% in patients with Systolic IABPD ≥ 10 mm Hg. Therefore, a difference of ≥ 10 mm Hg is regarded as significant and requires further evaluation.

The WHO has predicted that by 2030 almost 23.6 million people will die from CVD, mainly from heart disease and stroke. [2] Over 80% of CVD deaths occur in low- and middle-income countries. Most of the risk factors for CVD are high in young adults,[3] which support the fact that nearly half of the deaths due to CVD are occurring in young- and middle-aged individuals. Young adults with a family history (FH) of hypertension have increased the risk of developing hypertension. Compared to normotensive offsprings of

normotensive parents, normotensive offsprings of hypertensive parents had increased BP and impaired arterial properties. [4] So, the relation of FH of hypertension with raised IAD in BP has to be addressed. Raised IAD in BP in patients with FH of hypertension, stroke, peripheral vascular disease, or myocardial infarction may predict future disease development.

So, the objective of the study was to find the association of raised IAD in BP with FH of hypertension, stroke, CAD, and peripheral vascular disease.

II. MATERIALS AND METHODS

A medical institution-based cross-sectional study was conducted among MBBS students in Hind institute of medical sciences, Sitapur, during the period July 2021-October 2022 after approval by the Institutional Ethics Committee.

The study population consisting of 200 MBBS students aged 17-28 years were enrolled for the course during the academic years 2020 and 2021. Prior consent of subjects for clinical details was taken into account. After taking verbal consent and explaining the purpose of the study, family history of diabetes, hypertension and other chronic diseases was recorded. Blood pressure of both the arms was recorded in supine position by auscultatory method of BP measurement by mercury sphygmomanometer under standardized protocol after 10 min rest to the subject. Measurement was taken in the arm first presented , and the cuff was then swapped to the other arm and another measurement taken. Inter-arm BP difference is defined as the difference between average BP in the right arm and average BP in the left arm.

Statistical Methods

The data were coded and entered in Microsoft Excel and analyzed using SPSS version 16.0. Continuous variables were summarized as arithmetic mean and standard deviation. Chi-square test was used to find the relation between categorical variables. Correlation between inter-arm BP difference, BMI, height, weight, right and left arm MABP were done by Pearson's coefficient of correlation analysis. For all statistical analysis, the significance level was set at $P < 0.05$.

III. RESULTS

SIAD in BP ≥10 mm of Hg was present in 15.4% (44) patients. Diastolic IAD (DIAD) ≥10 mm of Hg was present in 1.7% (5) patients. Mean SIAD in BP was 5.923(±3.79) mm of Hg, and mean DIAD in BP was 3.16 (±3.48) mm of Hg.

Descriptives of anthropometric parameters and BP are described in Table 1. All variables were normally distributed.

FH of hypertension was present in 80 patients and 44 (23.1%) among them had raised IAD in BP, whereas 14 (9.9%) patients with no FH of hypertension had raised IAD in BP. The result was statistically significant (P = 0.002). FH of CAD, stroke, and peripheral vascular disease did not show a statistically significant association with raised IAD in BP (Table 2).

Table 1: Descriptives of anthropometric parameters and BP of study patients

Clinical/anthropometric measures	Mean±SD (*n*=200)
Height	160.97±10.276
Weight	54.34±10.652
BMI	20.357±3.07
SIAD	5.923±3.79
DIAD	3.16±3.48

BMI: Body mass index, SIAD: Systolic inter-arm difference, DIAD: Diastolic inter-arm difference, BP: Blood pressure

Table 2: Association of family history of hypertension, stroke, CAD, and PVD with IAD status

Family history status	IAD status		Value
	Present %	Absent %	
Hypertension			
Yes	30 (15)	50 (25)	0.002
No	14 (7)	106 (53)	
CAD			
Yes	12 (6)	55 (27.5)	0.26
No	13 (6.5)	120 (60)	
Stroke			

Yes	4 (2)	31 (15.5)	0.46
No	38 (19)	127 (63.5)	
PVD			
Yes	1 (0.5)	30 (15)	0.53
No	45 (22.5)	124 (62)	

CAD: Coronary artery disease, PVD: Peripheral vascular disease, IAD: Inter-arm difference

In the present study, both SIAD and DIADs in BP show a negative correlation with height in males and females. DIAD in BP shows a statistically significant (P = 0.002) negative correlation with height in females (Table 3& 4). Both SIAD and DIAD in BP show a positive correlation with BMI and weight in males and females, but the results were not statistically significant.

Table 3: Correlation of SIAD with anthropometric parameters

IAD	**Anthropometric parameters**	**Correlation coefficient**	***P* value**
SIAD in BP (males)	Height	−0.091	0.407
	Weight	0.186	0.08
	BMI	0.045	0.683
SIAD in BP (females)	Height	−0.041	0.565
	Weight	0.048	0.505
	BMI	0.091	0.201

BMI: Body mass index, , SIAD: Systolic Inter-arm difference, BP :blood pressure

Table 4: Correlation of DIAD with anthropometric parameters

IAD	**Anthropometric parameters**	**Correlation coefficient**	***P* value**
DIAD in BP (males)	Height	−0.21	0.849
	Weight	0.054	0.622
	BMI	0.02	0.983
DIAD in BP (females)	Height	−0.217	0.002
	Weight	0.129	0.070
	BMI	0.34	0.636

BMI: Body mass index, DIAD: Diastolic inter-arm difference, IAD: Inter-arm difference, BP: Blood pressure

IV. DISCUSSION

Many studies have found out that inter arm blood blood pressure difference of >10% is associated with the development of cardiovascular diseases. One of the studies supporting this has been published recently in 2022 by Gbaguidi et al [9] done in 1505 participants wherein they found >10mmhg SIABPD to be significantly associated with hypertension and diabetes. Similar findings were seen by Clark et al [3] and Verma et al[12].

In this study, raised IAD in BP shows a statistically significant association with family history of hypertension same as obtained by Pun DB et al. Therefore, recording of inter-arm BP difference showing raised IAD may be a predictor of the development of hypertension in future among those with family history of hypertension. Definite lifestyle modifications can be implemented to reduce BP for primary prevention of development of hypertension.

Anthropometric parameters such as height and weight were found to be associated with BP in several studies.[16,17] Aboyans et al.[18] and Su et al.[19] in their studies found a significant correlation between high BMI and SIAD in BP. Direct relation between DBP and height was found in a study by Song et al.[20] while inverse relation with DBP and height was found in a study by Davey Smith et al.[21] In the present study, both SIAD and DIADs in BP show a negative correlation with height in males and females. In females, DIAD shows a statistically significant negative correlation with height (P = 0.002).

Our study shows a significant association between raised IAD in BP and family history of hypertension. Family history of hypertension is a cardiovascular risk factor accounted in the inter heart study. Recent evidence as shown by a large cohort study [1] could strengthen our study findings, and these individuals have to be evaluated for concurrent cardiovascular risk factors.

V. CONCLUSION –

Hypertension guidelines have recommended that BP should be assessed in both arms at the initial visit. Assessment of BP in both arms should become a routine clinical practice in initial BP measurement in primary care. Raised IAD in BP along with raised MABP necessitates follow-up of these individuals for future cardiovascular events development. Measures should be initiated to prevent the development of hypertension and future CVD. Family history of hypertension is a non-modifiable risk factor for the development of hypertension. However, detection of raised IAD in BP and associated family history of hypertension warrants lifestyle modifications and regular follow-up of these patients for disease development in future.

REFERENCES –

[1]. Gopalakrishnan S et al. Evaluation of inter-arm difference in blood pressure as predictor of vascular diseases among urban adults in Kancheepuram District of Tamil Nadu. Journal of family medicine and primary care. 2018 ; 7(1): 142–146.

[2]. Christopher E. Clark. Inter-arm blood pressure difference, when is it a useful risk marker for cardiovascular events? Journal of human hypertension.2022;36:117-119.

[3]. Christopher E. Clark. Interarm Blood Pressure Difference in People With Diabetes: Measurement and Vascular and Mortality Implications: A Cohort Study. Diabetes Care. 2014;37(6):1613–1620.

[4]. Methre ST et al. Correlation of interarm blood pressure difference with family history of hypertension, anthropometric parameters, and mean arterial blood pressure in normotensive people. National journal of physiology, pharmacy and pharmacology. 2021; 11(1):23-27.

[5]. Agarwal R et al. Prognostic significance of between-arm blood pressure differences. Hypertension, 2008;51 (3):657-662.

[6]. Hoeven NV et al. Simultaneous compared with sequential blood pressure measurement results in smaller inter-arm blood pressure differences. Journal of clinical hypertension. 2013;15(11):839-844.

[7]. Das S et al. Inter-arm blood pressure difference as a tool for predicting coronary artery disease severity. Open heart. 2022 ;9(2):e002063

[8]. Clark CE et al. Inter-arm blood pressure difference and mortality: a cohort study in an asymptomatic primary care population at elevated cardiovascular risk. The British journal of general practice. 2016;66(646):e297-308.

[9]. Gbaguidi GN et al. inter arm difference in systolic blood pressure: prevalence and associated factors in an African population. Plos one. 2022; 17(8):e0272619.

[10]. Zhou L et al. Family history of hypertension and arterial elasticity characteristics in healthy young people. Hypertension research. 2008;31(5):833-839.

[11]. Clark CE et al. The difference in blood pressure readings between arms and survival: primary care cohort study. Biomedical journal. 2012; 344: e1327.

[12]. Verma MK et al. Interarm Blood Pressure Difference, Pulse Pressure, and Mean Arterial Pressure as Predictors of Cardiovascular Disease Risk in Young Adults. International journal of clinical and experimental physiology. 2018; 5(1):44-47.

[13]. Abdulrahmanessa et al. Prevalence of inter-arm blood pressure difference among young healthy adults: Results from a large cross-sectional study on 3235 participants. Annals of medicine and surgery. 2022;77: 103631.

[14]. Song BM et al. Comparison between Right and Left Upper Arms in Detection of Hypertension. Korean Circulation Journal. 2019;49(3):267-277.

[15]. Kranenburg G et al. Inter-arm systolic blood pressure differences, relations with future vascular events and mortality in patients with and without manifest vascular disease. International Journal of Cardiology. 2017; 244: 271-276.

[16]. Tokitsu T et al. Relationship between inter-armblood pressure differences and future cardiovascular events in coronary artery disease. Journal of Hypertension. 2015;33(9) :1780-1790.

[17]. Miyashima M et al. Inter-Arm Blood Pressure Difference in Diabetes Mellitus and Its Preferential Association with Peripheral Artery Disease. Journal of Atherosclerosis and Thrombosis Japan Atherosclerosis Society. 2003; 52886

[18]. Clark CE. Association of a difference in systolic blood pressure between arms with vascular disease and mortality: a systematic review and meta-analysis.2012. The Lancet; 379(9819):905-914.

[19]. Ghahdarijani KH et al . The relation between inter arm blood pressure difference and presence of cardiovascular disease: a review of current findings. 2022. Current problems in cardiology;47(11):101087.

[20]. Idoweinberg et al. The Systolic Blood Pressure Difference Between Arms and Cardiovascular Disease in the Framingham Heart Study.2014. The American Journal of Medicine;127(3):209-215.

[21]. Deirdre L et al. Inter-arm differences in blood pressure: when are they clinically significant? 2002**.** Journal of Hypertension ;20(6): 1089-1095.

[22]. Johansson JK et al. Interarm blood pressure difference and target organ damage in the general population.2014. Journal of Hypertension ;32(2):260-266.

[23]. Sukhchain S et al. Prevalence of simultaneously measured interarm systolic blood pressure difference and its clinical and demographic predictors: a systemic review and meta-analysis.2015. Blood Pressure Monitoring;20(4):178-185(8).

[24]. Yu S et al. Association of interarm blood pressure difference with cardio-cerebral vascular disease: A community-based, cross-sectional study. 2019.The journal of clinical hypertension;21(8):1115-1123.

[25]. Donna KA et al**.** Interarm differences in seated systolic and diastolic blood pressure: the Hypertension Genetic Epidemiology Network study. 2005. Journal of Hypertension ;23(6): 1141-1147.

[26]. Ma W et al. Correlating the relationship between interarm systolic blood pressure and cardiovascular disease risk factors. 2017.The journal of clinical hypertension ;19(5):466-471.

[27]. Peebles KC et al. Interarm Differences in Brachial Blood Pressure and their Effect on the Derivation on Central Aortic Blood Pressure. 2020.Artery research;26(2):89-96.

[28]. Pun D B et al. Inter-arm blood pressure difference in healthy young adults: a cross-sectional study.2020. Journal of Physiological Society of Nepal;1(1): 8–13.