

Research Article

Inter arm blood pressure difference: an indicator of cardiovascular risk

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Received: 26 October 2015

Revised: 27 October 2015

Accepted: 20 November 2015

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ABSTRACT

Background: Overall prevalence of hypertension in India is 33% in urban and 25% in rural areas. For optimal health blood pressure of less than 120 mm of Hg systolic and 80mm of Hg diastolic is to be maintained. According to American heart association, inter arm BP difference of more than 20 mm of Hg systolic and 10 mmm of Hg diastolic are associated with peripheral vascular disease, vasculitis, connective tissue disorders and congenital anomalies. Though the guidelines quote that it is mandatory to examine pressure in both arms before diagnosing hypertension this system is not followed, which has led to increase in misdiagnosis of HT. The present study aims to determine the magnitude of interarm difference in young healthy individuals and to assess whether family history of HT and BMI is related to higher interarm difference.

Methods: 110 normal healthy medical students both males & females are recruited for the study .after obtaining institutional ethical clearance the participants in the study are informed about the study process and detailed history obtained .after 5 min of rest BP is assessed by sphygmomanometer first in right arm & then left. Statistical analysis done using paired t test, correlation between variables done with chi square test.

Results: statistically significant difference $p < 0.0001$ noted in interarm systolic and diastolic bp ,which shows that pressure difference exists between two arms hence it is mandatoty to assess bp in both arms and the higher of the two is taken as normal .subjects with family history of hypertension had interarm sytolic bp > 10 mm of Hg and diastolic interarm > 5 mm of Hg ,though this value is not statistically significant ,it shows that people with family history of hypertension is more prone to interarm BP difference.

Conclusions: Interarm difference exists in norma lhealthy volunteers and interarm difference of > 10 mm of Hg systolic & > 5 mm of Hg diastolic should be investigated further as these subjects are more prone to develop cardiovascular morbidities .hence we conclude that interarm difference is a sensitive noninvasive and simple method of detecting individuals prone for cardiovascular morbidities.

Keywords: Interarm blood pressure, Hypertension, BMI, CVS morbidity

INTRODUCTION

Hypertension is considered as an “iceberg “disease globally.57% of deaths from stroke and 24% of deaths from coronary heart disease in India are due to hypertension. Overall prevalence of hypertension in India is 33% in urban and 25% in rural areas.¹ For optimal health blood pressure of less than 120 mm of Hg systolic and 80mm of Hg diastolic is to be maintained as

recommended by American Heart Association. Several dimensions of blood pressure assessment like systolic bp, diastolic BP, pulse pressure, mean arterial pressure etc are associated with increased risk of vascular diseases. In addition to these dimensions, interarm difference in BP is identified as a risk factor for cardiovascular morbidity. According to American heart association, interarm BP difference of more than 20 mm of Hg systolic and 10 mmm of Hg diastolic is associated with peripheral

vascular disease, vasculitis, connective tissue disorders and congenital anomalies.²⁻⁴

WHO guidelines advocate the measurement of BP in both arms as an initial assessment of hypertension and the arm with higher BP values should be checked in subsequent visits.⁵ This emphasis on measurement in both arms prevents the misdiagnosis of hypertension due to normal difference in BP between arms. Several studies correlating the interarm BP differences with cardiovascular morbidity have been reported but there are no large scale studies addressing the magnitude of interarm difference in healthy individuals. The reference values of interarm BP difference as quoted by international studies may not be valid to the Indian population due to difference in demographic factors.⁶

Hence the present study was undertaken to establish the normal range for the difference in blood pressure measured, both systolic and diastolic, between right and left arm in young healthy individuals. This study also addresses whether there is any correlation between family history of hypertension and BMI with interarm BP difference. Previous studies show conflicting reports regarding the relationship of Inter arm BP difference and BMI, family history of hypertension.⁷

METHODS

This cross-sectional descriptive study was conducted in the department of Physiology, JMMC &RI, Thrissur. After obtaining consent from Institutional Ethical Committee, 110 MBBS students both male and females of 18-25 years were recruited for the study. Those with pre-existing hypertension, peripheral vascular diseases, cardiovascular disorders, dyslipidemia, limb abnormalities and renal disorders were excluded. After getting informed consent, detailed history is taken, and then height, weight and BMI were assessed. Subject is seated in a room for 5 minutes, then BP was measured in both arms sequentially, first right arm, then left arm using sphygmomanometer.

RESULTS

Table 1: Baseline parameters of the subjects.

Characteristics mean± SD	Characteristics mean± SD
Age	19.80± 1.148
Height	161.75± 8.59
Weight	56.15 ± 9.32
BMI	21.32 ± 3.038

110 students aged 18 to 25years (81 females & 29 males) were enrolled in this study .Blood pressures of both arms are compared by paired t test .Correlation between interarm BP difference , BMI and family history is done by pearson’s coefficient of correlation analysis. Table 1

and represents the baseline details of the participant recruited for the study.

Table 2: Systolic and diastolic BP in right and left arm.

	Right arm mean± SD	Left arm mean± SD	P value
Systolic	107.87± 11.59	101.73± 10.588	<0.0001*
Diastolic	71.73 ± 8.756	70.62 ± 8.167	<0.0001*

*P value < 0.0001 is significant.

Table 3: Systolic and diastolic interarm BP difference.

	Systolic inter arm BP difference		Diastolic inter arm BP difference	
	<10	>10	<5	>5
Frequency	59	51	72	38
Total	110		110	

Of the 110 subjects, 59 had systolic interarm difference less than 10 mm of Hg and 72 had diastolic interarm difference less than 5 mm of Hg (Table 3).

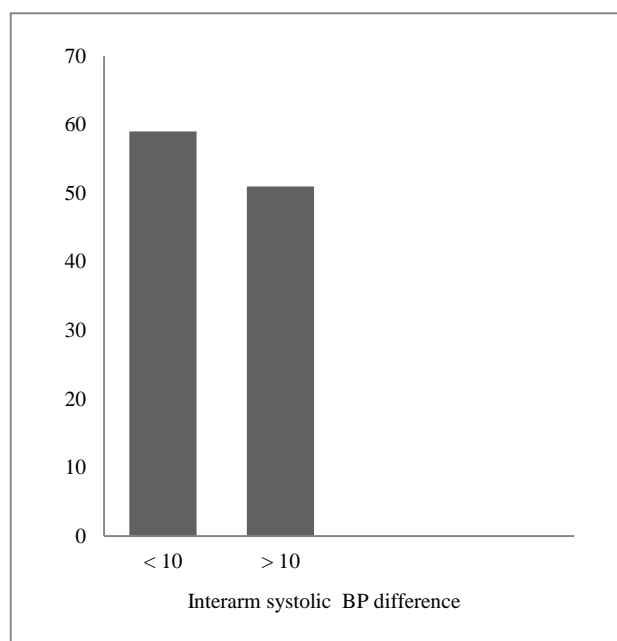


Figure 1: Frequency of subjects with interarm systolic difference <10 and >10 mm of Hg.

Of the 110 subjects in the study, 51 (46%) had systolic interarm BP difference more than 10 mm of Hg and in them 34 had positive family history of hypertension .The diastolic interarm BP difference of more than 5 mm of Hg seen in 38 subjects (35%) in which 24 had positive family history of hypertension as shown in table 5.

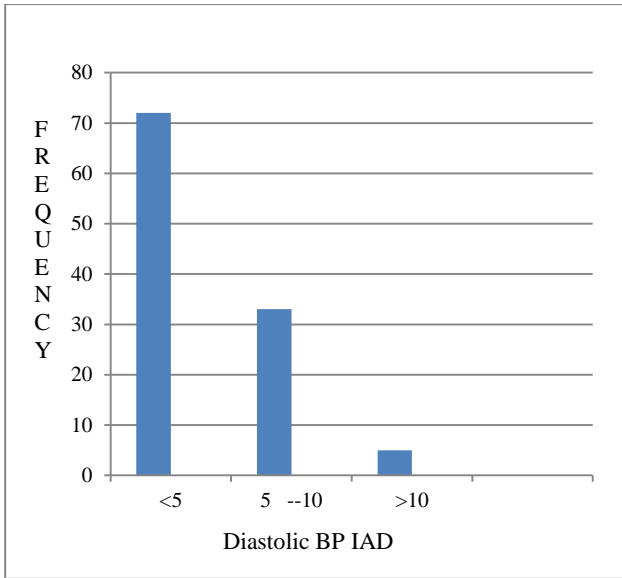


Figure 2: Frequency of subjects with interarm diastolic difference <5 & >5 mm of Hg.

Table 4: Interarm systolic and diastolic difference.

Parameters	Mean ± SD	P value
Interarm systolic BP difference	7.81± 7.01	< 0.0001*
Inter arm diastolic BP difference	3.98± 4.56	< 0.0001*

*p value <0.0001 significant.

Table 5: Correlation of family history of hypertension and interarm BP.

Family history	Frequency	Systolic inter arm BP difference		Diastolic inter arm BP difference	
		< 10	>10	< 5	>5
No	40	23	17	26	14
Yes	70	36	34	46	24
Total	110	59	51	72	38
*r value		0.377		1.34	
p value		0.539		0.512	

*r value > 0.05 to 1 indicates positive correlation.

In the 51 subjects with interarm systolic pressure more than 10 mm of Hg, 40 had BMI in the normal range, only 8 had BMI less than 18 and 3 with BMI more than 25. The diastolic interarm difference of more than 5, 38 subjects present and 31 had normal BMI while 3 with less than 18 BMI and 4 with more than 25 BMI.

DISCUSSION

The present study examined the interarm blood pressure difference in young healthy males and females. It confirms the presence of inter arm difference in systolic

and diastolic blood pressure measurements in young, healthy individuals, with higher pressure on right arm. In the present study, it was found that subjects with family history of hypertension had systolic interarm difference of more than 10 which further shows that these subjects have more chances of developing hypertension in future. Hence interarm difference helps in early detection of risk for hypertension and timely modification of life style can be done to do better. Though past studies have found a significant correlation between BMI and interarm BP difference, in the present study no significant correlation was noted.

As per previous studies, if the systolic BP difference is >20 mm Hg and diastolic BP difference is > 10 mm Hg, it is abnormal. They require aggressive management along with secondary prevention guidelines i.e, life style changes. Though the guidelines suggest increase in systolic BP difference of more than 20 mm Hg is associated with cardiovascular morbidity, there are numerous studies stating that interarm systolic BP difference of more than 10 has significant correlation to cardiovascular morbidity.²

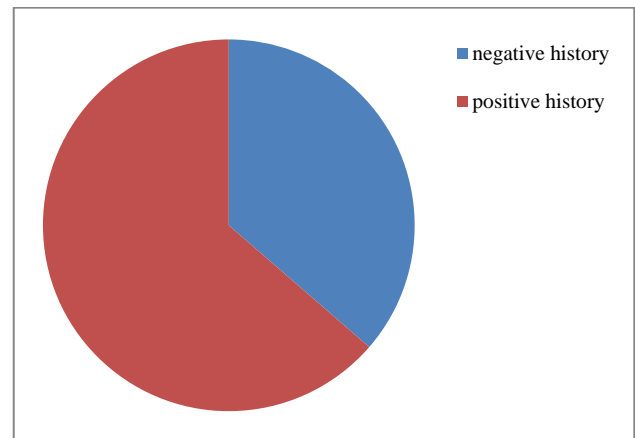


Figure 3: Percentage of subjects with family history of hypertension or other cardiovascular morbidities. 64 % had positive family history of hypertension and 36 % were with negative history.

Table 6: Correlation of BMI and interarm BP.

BMI	Systolic inter arm BP difference		Diastolic inter arm BP difference	
	< 10	>10	< 5	>5
< 18	2	8	7	3
18- 25	52	40	61	31
<25	5	3	4	4
total	59	51	72	38
	110		110	
	p value 0.078		p value 0.073	

*p value < 0.05 is significant.

The reference values for interarm BP as quoted by international guidelines differs slightly from our population. Interarm difference of less than 10 mm of Hg systolic and less than 5 mm of Hg diastolic can be taken as normal in our setting. Hence any values above this should be taken as an indicator of future cardiovascular risks so that they need to be investigated in detail.

Hence from this study we conclude that normal interarm BP difference exists and it may be due to the anatomical variations. The magnitude of difference is noted as <10 mm of Hg systolic and <5 mm of Hg diastolic .we also hypothesis that interarm difference increases in subjects with positive family history of hypertension indicating that these subjects are more prone to develop cardiovascular morbidities in future. Hence interarm BP measurement can be utilized as a simple noninvasive indicator of risk factors for cardiovascular morbidities. The measurement of interarm BP should be made mandatory in primary care settings which would help to identify at risk individuals and ensure proper care.

CONCLUSIONS

Following conclusions drawn from our study.

1. Interarm blood pressure difference is seen in healthy young adults and higher pressure noted in rt arm.
2. Interarm difference of less than 10/5 mmHg is considered to be normal.
3. Systolic difference of more than 10 and diastolic difference of more than 5 noted in subjects with family history of hypertension.
4. No significant association noted between correlation between BMI and interarm difference.

Limitations of the study

A recent meta-analysis shows that simultaneous, automated and repeated measurement with one or two machines should be ideal.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Gupta R. Trends in hypertension epidemiology in India. J Hum Hypertens. 2004;18:73-8.
2. CE Clark, JL Campbell, PH Evans, A Millward. Prevalence and clinical implications of the inter-arm blood pressure difference: a systematic review. Journal of Human Hypertension. 2009;20:923-31.
3. Kyoung Bog Kim, MiKyeong Oh, HaaGyoung Kim, JiHoonKi, SooHee Lee, Su Min Kim. Interarm differences in simultaneous blood pressure measurements in ambulatory patients without cardiovascular diseases. Korean J Fam Med. 2013;34(2):98-106.
4. Christopher E Clark, John L Campbell, Roy J Powell, John F Thompson. The inter-arm blood pressure difference and peripheral vascular disease: cross-sectional study. Family Practice.2007;24:420-6.
5. Williams B, Poulter NR, Brown MJ, Davis M, McInnes GT. (2004) Guidelines for management of hypertension: report of the fourth working party of the British Hypertension Society,* BHS IV. J Hum Hypertens. 2004;18:139-85.
6. National High Blood Pressure Education Program. Working Group on High Blood* Pressure in Children and Adolescents. The fourth report on the diagnosis, evaluation, and treatment of high blood pressure in children and adolescents. Pediatrics. 2004;114:555-76.
7. Christopher E Clark, Rod S Taylor, Angela C Shore, John L Campbell. The difference in blood pressure readings between arms and survival: primary care cohort study. British Medical Journal. 2012;344:e1327.
8. Agarwal R, Bunaye Z, Bekele DM. Prognostic significance of Between- arm Blood Pressure Differences. Hypertension. 2008;51:657-62.
9. Weinberg I, Gona P, O'Donnell CJ, Jaff MR, Murabito JM. The Systolic Blood Pressure difference Between Arms and Cardiovascular disease in the Framingham Heart study. The American Journal of Medicine. 2014;127(3):209-15.
10. Bursztyn M. Inter-Arm Blood Pressure Difference. The Journal of Clinical Hypertension. 2013; 15 (11):774-5.
11. Pesola GR, Pesola HR, Nelson MJ, Westfal RE. The Normal Difference in bilateral indirect blood pressure recordings in normotensive individuals. Am J Emerg Med. 2001;19:43-5.
12. Orme S, Ralph SG, Birchall A, Lawson – Matthew P, McLean K, Channer KS. The normal range for inter-arm differences in blood pressure. Age and ageing. 1999;28:537-42.
13. Cassidy P, Jones K. A study of inter-arm blood pressure differences in primary care. Journal of Human Hypertension. 2001;15:519-22.

Cite this article as: Seethalakshmi K, Bahuleyan B. Inter arm blood pressure difference: an indicator of cardiovascular risk. Int J Res Med Sci 2015;3:3782-5.