



# INTERARM BLOOD PRESSURE; DIFFERENCE IN YOUNG HEALTHY MEDICAL STUDENTS

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**ABSTRACT:** Interarm blood pressure difference is linked to various peripheral arterial disease and thus occupies great significance in vascular medicine. Due to various physiological & pathological changes vessels suffer with hardening that produces measurable inter arm blood pressure difference. Less than one in 5 physicians is interested in measuring blood pressure in both arms. **Objectives:** to study the interarm blood pressure difference among medical students and its association with age, gender, BMI. **Study Design:** Cross-sectional study. **Setting:** Karachi. **Period:** September 2015 to November 2015. **Methodology:** Data was collected from 305 individuals, Blood pressure was measured by designated technician with students in sitting position with at least 5 minutes of rest, among healthy nonsmokers medical students of DUHS. **Results:** Mean weight of individuals was 57.4+- 12.9 kg. Mean height was found to be 164.6+-9.5 mm of Hg. Mean BMI of individuals was 21.0 +-3.78 kg/m<sup>2</sup>. Mean right arm systolic blood pressure was found to be 102.9+-13.4 mm of Hg. Mean right arm diastolic pressure was found to be 64.1+-12.8 mm of Hg. Mean left arm systolic blood pressure was found to be 101.8 +-13.0 mm of Hg. Mean left arm diastolic blood pressure was found to be 64.4+-12.9 mm of Hg. Mean interarm systolic blood pressure was found to be 7.4+-7.6 mm of Hg. Mean interarm diastolic blood pressure difference was found to be 8.6+-8.5 mm of Hg. **Conclusions:** Regular measurement of blood pressure in both arms and assessment of interarm blood pressure difference can lead to a new era where vascular events can be diagnosed at an earlier stage and thus treated earlier

**Key words:** Blood Pressure, Hypertension, Interarm Blood Pressure, BMI.

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## INTRODUCTION

Interarm blood pressure difference can be observed among the general populations but it plays a significant role in the patients with known co-morbid such as diabetes, chronic renal failure, peripheral vascular diseases, also those with the acute ischemic strokes.<sup>1,2</sup> Blood pressure difference among the arms has been found but to what extent its role is & its prognostic value has always been found to be scarce. According to the guidelines for hypertension from the National Institute for Health and clinical Excellence, interarm bp difference of less than 10 attributes to be normal & if it is greater than 20, it points towards the vascular disease<sup>2</sup>

Article review shows that in United Kingdom less than one in five physicians is interested in measuring blood pressure difference in both

the arms.<sup>3</sup> Main reason behind this is lack of knowledge of its prevalence and importance. However, Hypertension evaluation and treatment guidelines, BP measurement guidelines and widely recognized HTN textbook recommend assessing BP in both arms.<sup>4,5</sup> Blood pressure should always be measured in both arms, by taking it three times in each arm & then calculating mean blood pressure and arm with higher reading should be used as a diagnostic significance with the proper analysis with various comorbid<sup>6</sup> & these pathologies have their prior associations with the obesity, height & life style, therefore we came forward with ideation to measure the interarm BP difference in young medical students, to assess its association with the waist, height, age. In majority of studies, blood pressure in right arm is found to be higher than that in left arm.<sup>7,8,9</sup>

Due to various physiological & pathological changes vessels suffer with hardening that produces measurable inter arm blood pressure difference.<sup>10</sup> Inter arm blood pressure difference can be seen some young healthy individuals but mainly it is associated with increased risk of cardiovascular events, chronic kidney disease, subclavian artery stenosis, aortic stenosis, aortic coarctation, vasculitis, fibro muscular hyperplasia, connective tissue disorders, thoracic outlet syndrome and other peripheral vascular diseases.<sup>11,12</sup> If an inter arm blood pressure is not assessed during clinical examination than this could delay the diagnosis and ultimately treatment of these events.<sup>13</sup>

The new clinical guideline for HTN from National Institute for health and clinical excellence considers inter arm difference of less than 10 mm of Hg to be normal and greater than 20 mm of Hg to be associated with underlying vascular diseases.<sup>14</sup>

For assessing inter arm blood pressure difference, pressures in both arms should be simultaneously measured. Previous studies have illustrated the interarm bp difference in patients with medical problems & also two studies have been done on healthy individuals, but there had been no studies done on medical students, this study can also be used as a tool to convey the significance of interarm bp difference.

## METHOD

This is a cross-sectional study done in Karachi. Data was collected from 305 individuals during the period of September 2015 to November 2015 from young, healthy, non-smoker medical students studying in Dow University of Health Sciences. Blood pressure was measured by designated technician with students in sitting position with at least 5 minutes of rest. Blood pressure was measured in one arm and sequentially in the other arm using mercury sphygmomanometer as it is considered gold standard for measurement of blood pressure. It was made sure that the size of cuffs in correct for the student's arm circumference. Technicians

were well-trained in listening Kortakoff sounds. Which arm to be measured first was randomly selected. Data of individuals with left dominant hand was excluded and only those with right hand dominant were included to be a part of this study. Weight, height and hip waist ratio were then measured. SPSS-20 was used for statistical analysis. Four readings were taken with 2 minutes of rest after each reading to reduce any chances of error. We determined the mean of four readings and calculated the difference between systolic bp in right & left arm by subtracting them from each other. T-test was used to evaluate association between IAD and age, gender, height, weight, hip to waist ratio and BMI. P-values < 0.05 were considered to be significant.

## RESULTS

Of 305 individuals 199 were females and 106 were males. Aged between 18–20 were 193, 21–23 were 80 and 23 to 26 were 32.

Results are reported as Mean +\_ Standard Deviation.

Mean weight of individuals was 57.4+- 12.9 kg. Mean height was found to be 164.6+-9.5 cm. Mean BMI of individuals was 21.0 +-3.78 kg/m<sup>2</sup>. Mean right arm systolic blood pressure was found to be 102.9+-13.4 mm of Hg. Mean right arm diastolic pressure was found to be 64.1+-12.8 mm of Hg. Mean left arm systolic blood pressure was found to be 101.8 +-13.0 mm of Hg. Mean left arm diastolic blood pressure was found to be 64.4+-12.9 mm of Hg.

Mean interarm systolic blood pressure was found to be 7.4+-7.6 mm of Hg. Mean interarm diastolic blood pressure difference was found to be 8.6+-8.5 mm of Hg.

When T-test was applied to difference in systolic blood pressure difference and BMI then p-value was found to be <0.05(0.000).

## INTERARM SYSTOLIC BLOOD PRESSURE DIFFERENCE

When T-test was applied to difference in systolic

blood pressure and gender then p-value was found to be <0.05(0.000) (Confidence Interval= 95%).

Individuals having difference in systolic blood pressure of zero mm of Hg was found in 124 individuals(50males, 74 females), of 5 mm of Hg was found in 8 individuals(8 males, no females), 10 mm of Hg in 132(38males, 93females), 15mm of Hg in 1(1 male, no female), 20mm of Hg in 32(5 males, 27females), 23mm of Hg in 1 male, 30mm of Hg in 6(2 males, 4 females), 45 mm of Hg in 1 female. (Figure-1).

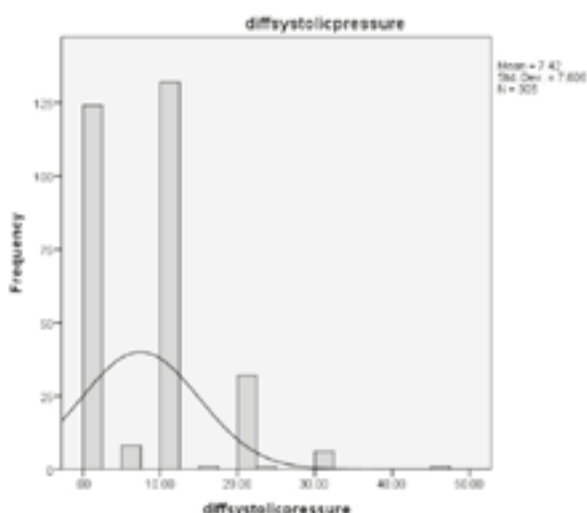


Figure-1. Difference in systolic blood pressure in medical students

### INTERARM DIASTOLIC BLOOD PRESSURE DIFFERENCE

When T-test was applied to difference in diastolic blood pressure and gender then p-value was found to be <0.05(0.000) (CI= 95%).

Individuals having interarm diastolic blood pressure of zero mm of Hg in 105 individuals(42 males, 63 females), 1 mm in one male, 5 mm of Hg in 22(14 males, 8 females), 10 mm of Hg in 120(40 males, 80 females), 15 mm of Hg in one male, 20 mm of Hg in 40(6 males, 34 females), 25 mm of Hg in 1 male, 1 female, 30 mm of Hg in 11(1 male, 10 females, 40 mm of Hg in 3 females (Figure-2).

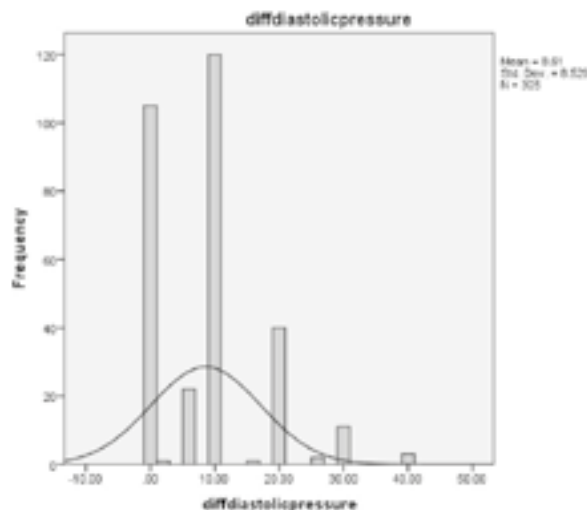


Figure-2. Difference in diastolic blood pressure in medical students

### DISCUSSION

One purpose of the article is also to pinpoint the significance of measuring interarm blood pressure difference (IAD) among young physicians of our society. Though interarm blood pressure difference is a considered as a marker for peripheral arterial disease when present in patients with chronic hypertension, cardiovascular disorders, chronic kidney disease and other vascular disorders but our study puts forwards that a group of healthy medical students also show IAD. Various studies considered IAD of greater than 10 mm of Hg as significant while others considered IAD of greater than 20 mm of Hg to be significant<sup>12</sup> Individuals selected in our study were all young and healthy but 2.29% of them showed interarm systolic pressure difference greater than 20 mm of Hg while 5.24% of individuals showed interarm diastolic pressure difference greater than 20 mm of Hg.

IAD is also associated with certain factors such as weight, height, Body Mass index. Our study shows association of systolic blood pressure difference with gender and BMI.

Studies have shown that interarm blood pressure difference decreased as the number of readings taken were increased suggesting that difference in blood pressure existed because of random

variation.<sup>15</sup> For accurate measurement of blood pressure, blood pressure in both arms should be measured simultaneously in both arms. This is the limitation of our study as we measured blood pressure in both arms separately. Harrison showed that 26% of patients had difference of >10 mm of Hg which reduced to 5.3% when simultaneous readings were taken with cuffs joined by T-tube.<sup>16</sup>

Raised Systolic blood pressure causes various cardiac diseases such as MI, angina, intracerebral hemorrhage, subarachnoid hemorrhage, ultimately affecting the life styles of the individuals.<sup>18</sup>

In this study systolic blood pressure difference was found to be significantly associated with the male gender.

There was significant association found between gender and diastolic blood pressure difference, this difference is also found to be significant in another study published<sup>17</sup>, patients with the diastolic blood pressure are at the greater risk of the development of abdominal aneurysms, along with the peripheral arterial disease which promotes atherosclerosis causing limb amputation at early age.<sup>18</sup>

In this study Interarm blood pressure difference was found to be significantly associated with the Body mass index, previously article review reveals the significant associations between these two variables<sup>19</sup>, further more raised interarm blood pressure difference has number of complications associated with BMI.<sup>20,21</sup>

However regular measurement of blood pressure in both arms and assessment of interarm blood pressure difference can lead to a new era where vascular events can be diagnosed at an earlier stage and thus treated earlier. In spite of this Ankle Brachial Index should also be assessed as increased inter arm blood pressure difference and raised ABI can point towards PAD.

## CONCLUSION

Inter arm blood pressure difference has enormous significance, systolic blood pressure and diastolic blood pressure has significant association with the male gender, similarly those with high BMI are at higher risk of the raised systolic blood pressure difference, therefore physicians must be educated to measure blood pressure in both arms.


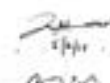
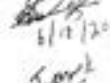
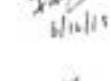

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## REFERENCES

1. Kim J1, Song TJ, Song D, Lee HS, Nam CM, Nam HS, Kim YD, Heo JH. **Interarm blood pressure difference and mortality in patients with acute ischemic stroke.** *Neurology.* 2013 Apr 16; 80.
2. National Institute for Health and Clinical Excellence. **Hypertension: the clinical management of primary hypertension in adults,** CG127. NICE, 2011.
3. Heneghan C, Peresa R, Mant D, Glaszion P, **Hypertension guideline recommendations in general practice: awareness, agreement, adoption and adherence.** *Br J Gen Pract* 2007;57:948-952
4. Mancia G, Fagard R, Narkiewicz K, et al. **2013 ESH/ESC Guidelines for the management of arterial hypertension: the Task Force for the management of arterial hypertension of the European Society of Hypertension (ESH) and of the European Society of Cardiology (ESC).** *J Hypertens.* 2013; 31:1281–1357.
5. Chobanian AV, Bakris GL, Black HR, et al. **Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. National Heart, Lung, and Blood Institute; National High Blood Pressure Education Program Coordinating Committee.** Seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. *Hypertension.* 2003; 42:1206–1252.
6. O'Brien E, Parati G, Stergiou G, et al. **on behalf of the European Society of Hypertension Working Group on Blood Pressure Monitoring. European Society position paper on ambulatory blood pressure monitoring.** *J Hypertens.* 2013; 31:1731–1768.
7. Pickering TG, Hall JE, Appel LA, et al. **Recommendations for blood pressure measurement in humans and experimental animals: Part 1: blood pressure measurement in humans: a statement for professionals from the Subcommittee of Professional and Public Education of the American Heart Association Council on High Blood Pressure Research.** *Hypertension.* 2005; 45:142–161.

8. Christopher E Clark, Rod S, Angela C, **John L Campbell** **The difference in blood pressure readings between arms and survival: primary care cohort study**, *BMJ* 2012;344.
9. Su HM, Lin TH, Hsu PC, et al. **Association of interarm systolic blood pressure difference with atherosclerosis and left ventricular hypertrophy**. *PLoS ONE*. 2012; 7:e41173.
10. Clark CE, Taylor RS, Shore AC, et al. **Association of a difference in systolic blood pressure between arms with vascular disease and mortality**.
11. Jesper Mehlsen, Neils Wiinberg, **Inter arm difference in blood pressure: Reproducibility and association with Peripheral vascular disease**. *International Journal of vascular medicine*, vol 2014.
12. Williams B. **Hypertension in the young: preventing the evolution of disease versus prevention of clinical events**. *J Am Coll Cardiol* 2007; 50: 840–842.
13. Clark CE, Campbell JL, Evans PH, Millward A. **Prevalence and clinical implications of the inter-arm blood pressure differences: a systemic review**. *J Hum Hypertens*.
14. Aboyans V, Criqui MH, McDermott MM, Allison MA, Denenberg JO, Shadman R, et al **The vital prognosis of subclavian stenosis**. *J Am Coll Cardiol* 2007, 49; 1540-5.
15. K.Eguchi, M.Yacoub, J. Jhalani, W. Gerin, J.E. Schwartz, and T.G. Pickering, **“Consistency of blood pressure differences between left and right arms,”** *Archives of clinical medicine*, vol. 167, no. 4, pp.388-393, 2007.
16. Harrison EG, Roth GM, Hines EAZ. **Bilateral indirect and direct arterial pressure**. *Circulation* 1960; 22: 419–435.
17. Fonseca-Reyes S<sup>1</sup>, Forsyth-MacQuarrie AM, García de Alba-García JE. **Simultaneous blood pressure measurement in both arms in hypertensive and nonhypertensive adult patients**. *Blood Press Monit*. 2012 Aug; 17(4):149-54.
18. Eleni Rapsomaniki, Adam Timmis, Julie George, Mar Pujades-Rodriguez, Anoop D Shah, **MRCP Spiros Denaxas, PhD Ian R White, PhD Prof Mark J Caulfield, MD Prof John E Deanfield, FRCP Prof Liam Smeeth, FRCGP Prof Bryan Williams, FRCP Prof Aaron Hingorani, FRCP Prof Harry Hemingway, FRCP**. Blood pressure and incidence of twelve cardiovascular diseases: lifetime risks, healthy life-years lost, and age-specific associations in 1.25 million people. *May 2014*; 383 :1899–1911.
19. Resnicow K<sup>1</sup>, Futterman R, Vaughan RD. **Body mass index as a predictor of systolic blood pressure in a multiracial sample of US schoolchildren**. *Ethn Dis*. 1993 Fall; 3(4):351-61.
20. Delhaye C<sup>1</sup>, Wakabayashi K, Maluenda G, Belle L, Ben-Dor I, Gonzalez MA, Gaglia MA Jr, Torguson R, Xue Z, Suddath WO, Satler LF, Kent KM, Lindsay J, Pichard AD, Waksman R. **Body mass index and bleeding complications after percutaneous coronary intervention: does bivalirudin make a difference?** *Am Heart J*. 2010 Jun; 159(6):1139-46.

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4	Dr. Iram Aamir Siddiq	Critical review of the article	
5	Dr. Ushna Naeem	Data acquisition, analysis manuscript drafting	
6	Dr. Fasih Zafar	Data interpretation, proof reading	