Original Research Article

Study of Inter-arm systolic blood pressure difference in hypertensive individuals

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Abstract

Background: Arterial blood pressure, a routinely measured vital parameter is a key screening factor for future risks of cerebrovascular accidents, coronary heart diseases, renal failure, and hypertension. As the lifestyle of current generation is sedentary, there is an enormous increase in incidence of non communicable diseases. Apart from being a very simple efficient screening tool, the inter-arm difference in systolic blood pressure has been proven to be associated with future incidence of hypertension, coronary heart disease, stroke etc. This study was designed to focus on the incidence of increased inter-arm difference in systolic blood pressure in hypertensive individuals. **Aim**: To compare the inter-arm difference in systolic blood pressure (IADSBP) of hypertensive individuals with normal subjects. **Materials & methods**: The blood pressure of the hypertensive individuals and normal subjects were measured sequentially in both arms, three times with an interval of 5 minutes between each reading. The difference between the average values of the systolic blood pressures of both arms was taken as IADSBP. **Results**: The mean IADSBP value in hypertensive group was 11.6373 +/- 4.29221 mmHg as against 3.3007 +/- 2.50303 mmHg in control group. The 'p' value was statistically highly significant (<0.001). 43% of the hypertensive group had an IADSBP of 10 – 15 mmHg and 18% had a difference of 15 – 20 mmHg. **Conclusion**: This proves that measuring blood pressure in both arms will be instrumental in picking up the individuals with high IADSBP value and to monitor closely and prevent cardiovascular and cerebrovascular accidents.

Keywords: blood pressure, cerebrovascular accidents, coronary heart disease, hypertension, inter-arm systolic blood pressure difference (IADSBP), non communicable diseases.

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Introduction

Arterial blood pressure is one of the vital signs, routinely recorded in normal as well as diseased individuals. It is an efficient screening parameter for various diseases like stroke, coronary heart disease, renal failure, hypertensive retinopathy etc. It is one of the important modifiable risk factors for the above said disease entities.

The threat of hypertension to the economic burden on health care system is alarming. Given the life style of the present generation, prevalence of hypertension is increasing in an exponential manner. Hypertension is directly responsible for 57% of all stroke deaths and 24% of all coronary heart disease deaths in India.[1] The current prevalence of hypertension in India is about 33% in urban population and 25% in rural population.[2] The worst part is that majority are not even aware that they are hypertensive.

Although the gold standard method for measuring blood pressure is intra arterial measurement with a catheter, it is not practiced as it is invasive. The

indirect method using the sphygmomanometer is the most preferred screening stool as it is not expensive and non invasive.

Recently, there has been growing interest in the difference in the inter-arm blood pressure (IAD), especially because increased differences in systolic blood pressure is associated with greater risk of cardiovascular events.[3-6] Differences in blood pressure between arms, due to atherosclerosis is known to correspond to the presence or increased risk of cardiovascular disease, chronic renal disease, hypertension and peripheral vascular disease.[7]

Failing to measure blood pressure in both the arms can result in missing the diagnosis at an earlier stage. Also, failing to recognise the IAD in BP can confound the treatment of hypertension if the lower reading arm is measured. This study aims to detect the prevalence of IAD in systolic blood pressure (SBP) in hypertensive individuals.

Materials & methods

Clearance from Institutional Human Ethics Committee was obtained. A cross sectional study was done by recruiting 100 hypertensive subjects from general medicine OPD and an equal number of age and gender matched controls from general population. The sample population was calculated from previous studies. Subjects in age group 40 – 70 years of both genders, who were either under treatment for hypertension or diagnosed newly and started on drugs, were included in the hypertensive group. The criteria followed for diagnosing hypertension is American Heart Association's guidelines of BP above 130/90 mmHg. Those under treatment were also recruited irrespective of the duration of hypertension, duration of treatment and current value of BP.

Hypertensive subjects with a history of coronary artery disease, peripheral vascular diseases, diabetes, psoriasis, systemic lupus erythematosus, renal failure, those who were on drugs that may cause secondary hypertension and those who were acutely ill were excluded from the study.

Healthy subjects were those who didn't have a history or signs and symptoms suggestive of the above mentioned diseases, not diagnosed as hypertensive in the past, with blood pressure less than 120 / 80 mmHg and those who were not on drugs that might cause secondary hypertension.

Study was conducted for a period of 3 months from July 2018 to September 2018.

After obtaining written and informed consent from the subjects, they were asked to relax in sitting posture for 5 minutes. The subjects were asked to be on overnight fasting to exclude the influence of diet on blood pressure measurement. History was taken and clinical examination was done. The blood pressure was measured using LED sphygmomanometer of Diamond Company which is made in India. The measurement was done sequentially first in the right arm followed by the left arm. 3 readings were taken with an interval of 5 minutes each. The average of the readings was taken as the systolic blood pressure of that arm. The difference between the mean values was considered as the IADSBP of the subject. The difference was between the values irrespective of whichever arm was higher. For example, if the right arm's SBP was 120 mmHg and left arm's SBP was 118 mmHg, the IADSBP value is 2 mmHg. Even if the values were 118 & 120 respectively the difference would be taken as positive number i.e. 2 mmHg.

The mean IADSBP values of the two groups were compared by independent 't' test using SPSS 21.0 software.

Results

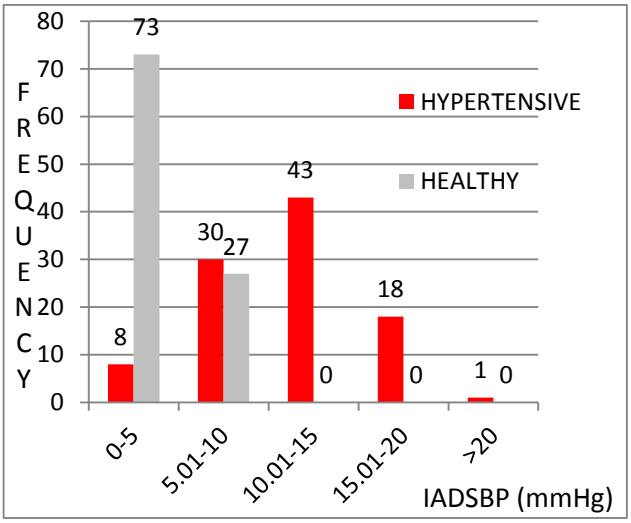
The average age in hypertensive group was 56.71 years with an SD of 8.32. In the healthy subjects group the average age was 51.35 years with an SD of 8.1. The average IADSBP of the hypertensive group was higher than the control group with a 'p' value of 0.0007 which was statistically highly significant. Also in our study, we could notice that in hypertensive group the percentage of people above the IADSBP value of 10mmHg were higher when compared to the control group.

TABLE 1: Comparison of IADSBP values of two groups

Group	Mean IADSBP (mm Hg)	Standard deviation	'p' value
Cases	11.6373	4.29221	0.0007
Controls	3.3007	2.50303	

IADSBP = inter- arm difference in systolic blood pressure

Fig 1: Frequency distribution of IADSBP



IADSBP = inter-arm difference in systolic blood pressure

Discussion

Hypertension is one of the major causes for many non communicable diseases like coronary artery diseases, cerebrovascular diseases and renal failure. This is the reason for including routine measurement of blood pressure as one of the vital signs. Detecting and lowering blood pressure earlier is found to bring down cardiovascular risk by 20 – 25% for myocardial infarction, by 50% for heart failure and by 40% for stroke.[8] American Heart Association and BP measurement guidelines recommend the measurement of blood pressure in both arms ideally in all visits or at least during the first visit. The arm with a higher reading should be used to measure BP in due course.[9] Framingham Heart Study (FHS) has suggested that an IADSBP of upto 10 mmHg is normal. Anything above this value is significantly associated with cardiovascular morbidity.[10] A study by Akira et al., has suggested an IADSBP cut off value of 5 mmHg in Japanese population.[11] This is also seen in our study where the frequency of people with IADSBP of more than 10 mmHg was higher in the hypertensive group when compared with the normotensive group.

Lane et al., study has demonstrated increased prevalence of raised IADSBP, thereby stressing on the fact that BP should ideally be measured in both the arms.[12] FHS demonstrated that IADSBP was associated with significantly increased risk of cardiovascular events.[13] Study conducted by Okada H et al., has shown that IADSBP was associated with elevated cardiovascular event rates.[14] A meta analytic review by Singh S et al., has proven that inter-arm and inter leg BP differences are strong predictors of peripheral vascular diseases and presence of inter limb BP difference indicates higher global cardiovascular (CV) risk.[15] Study by Ho Ming Su et al., has concluded that IADSBP of 10 mmHg or more was significantly associated with atherosclerosis and left ventricular hypertrophy.[16] Hypertension is one of the consequences of atherosclerosis and peripheral vascular diseases. Hypertension is an important risk factor for CV events.

This difference in SBP is attributed to atherosclerotic changes and vasculitis in the blood vessels. Other reasons include fibromuscular dysplasia and rarely subclavian stenosis.[17-21] IADSBP is an indicator of arterial stiffness.[22] With increased IADSBP values there is an oscillation of SBP values resulting in its disproportionate increase. Hence increase in IADSBP values indirectly point to increasing pathological changes in the blood vessels which again leads to cardiovascular and cerebrovascular morbidity and mortality in course of time.

This study retrospectively detects that hypertensives have increased IADSBP values. This type of study is more valuable if done as a prospective study. Since this parameter is a very easy, inexpensive tool, measuring BP in both arms can avoid falsely labelling hypertensives as normotensives by only taking reading from the

arm with lower value. When such an increase in IADSBP is detected the subjects can be promptly treated and followed up and thereby reducing the cardiac and cerebrovascular accidents.

Limitations

This study can be extended to a larger population. Simultaneous measurements of BP in both arms can reduce anxiety related changes in BP. We used manual method of measurement. There can be a subjective variation.

Future perspective

A prospective study can be done by detecting the subjects with higher IADSBP at the earliest and follow them through their adulthood thereby preventing the development of cardiovascular or cerebrovascular complications.

Conclusion

We conclude that measuring BP in both the arms is very important for earlier diagnosis of potentially disabling myocardial infarction and strokes. The arm with the higher BP should be noted. Also the hypertensives with increased IADSBP are at an increased risk of cardiac events and will require meticulous follow up and intensive treatment to prevent such morbidities.

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Conflict of interest: Nil

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