

# ORIGINAL ARTICLE

## Inter- arm differences in measurement of Blood Pressure- A Clinical Study

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### ABSTRACT:

**Background:** It is a standard practice to measure non-invasive blood pressure (NIBP) in the perioperative setting using oscillotonometric equipment. Measuring blood pressure (BP) in both the arms and their difference (IADs) is recommended by numerous guidelines to be performed at each first visit. The present study was conducted to investigating the influence of methodology of BP measurement on the IAD value. **Materials & Methods:** This study was conducted in the department of Anesthesiology in year 2017. It included 1240 subjects of both genders. Both systolic and diastolic blood pressure of both the arms was recorded using sphygmomanometer and stethoscope. **Results:** Out of 1240 subjects, males were 680 and females were 560. The difference was non- significant (P>0.1). There are differences between groups separated for measurement methods (simultaneous vs. sequential measurements), device (manual vs. automatic) and the number of readings (1 vs. 2 or more readings) used to determine IAD prevalence. The method of IAD performance had a significant influence on systolic (IAD  $\geq 10$  and 20 mm Hg) and diastolic (IAD  $\geq 10$ ) prevalence: sequential measurements led to a significant higher prevalence than simultaneous measurements (RR ranges from 2.4 to 4.6), the use of a manual BP device led to a significant higher prevalence than when using an automated device (RR ranges from 2.2 to 4.2). However, there was a strong relationship between devices and measurement methods: all, except one, simultaneous measurements were performed with automated devices. **Conclusion:** Method used for blood pressure evaluation has major influence on IAD differences. Blood pressure should be measured in both the arms to prevent overestimation and observer bias with one or two automatic devices and multiple readings should be taken.

**Key words:** Blood pressure, Stethoscope, Sphygmomanometer.

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This article may be cited as: Mahajan V, Gupta S. Tobacco Inter- arm differences in measurement of Blood Pressure- A Clinical Study. J Adv Med Dent Scie Res 2017;5(10):31-33.

Access this article online	
 <p>Quick Response Code</p>	Website: <a href="http://www.jamdsr.com">www.jamdsr.com</a>
	DOI: 10.21276/jamdsr.2017.5.10.08

## INTRODUCTION

Blood pressure (BP) is the pressure of circulating blood on the walls of blood vessels. Blood pressure usually refers to the pressure in large arteries of the systemic circulation. Blood pressure is usually expressed in terms of the systolic pressure over diastolic pressure and is measured in millimeters of mercury (mmHg), above the surrounding atmospheric pressure.<sup>1</sup>

It is a standard practice to measure non- invasive blood pressure (NIBP) in the perioperative setting using oscillotonometric equipment. Measuring blood pressure (BP) in both the arms and their difference (IADs) is recommended by numerous guidelines to be performed at each first visit. The difference in blood pressure in both the arms is indicative of the presence of congenital heart disease, peripheral vascular disease, unilateral neurological, musculoskeletal abnormalities, or aortic dissection.<sup>2</sup> Even if

the IAD has underlying pathology with it, relevant IADs i.e.,  $\geq 10$  mm Hg are still important to know, as office measurements consequently performed at the arm with the lowest BP can lead to a wrong diagnosis and under-treatment of hypertension. To verify the effectiveness of antihypertensive therapy it is of clinical importance that BP is measured in the same arm on all sequential occasions.<sup>3</sup> It is one of the vital signs, along with respiratory rate, heart rate, oxygen saturation, and body temperature. Normal resting blood pressure in an adult is approximately 120 millimetres of mercury systolic, and 80 millimetres of mercury diastolic, abbreviated "120/80 mmHg".<sup>4</sup> Even if there is large-scale recommendation of measuring blood pressure in both the arms, the procedure is not clearly described in the guidelines. Due to unavailability of the preferred method, there is wide variation in IAD assessment and interpretation with undesirable consequences.

Sometimes, overestimation of the IAD could lead to unnecessary referral to a specialist and cause an unnecessary burden for healthcare.<sup>5</sup> The present study was conducted to investigating the influence of methodology of BP measurement on the IAD value.

**MATERIALS & METHODS**

This study was conducted in the department of Anesthesiology in year 2017. It included 1240 subjects of both genders. All were informed regarding the study and written consent was obtained. Ethical clearance was taken from institutional ethical committee. General information such as name, age, sex etc. was recorded in case record proforma.

Both systolic and diastolic blood pressure of both the arms was recorded using sphygmomanometer and stethoscope. Results were tabulated and subjected to statistical analysis using chi- square test. P value <0.05 was considered significant (P< 0.05).

**RESULTS**

Table I shows that out of 1240 subjects, males were 680 and females were 560. The difference was non- significant (P-0.1). Tables II shows differences between groups separated for measurement methods (simultaneous vs. sequential measurements), device (manual vs. automatic) and the number of readings (1 vs. 2 or more readings) used to determine IAD prevalences. The method of IAD performance had a significant influence on systolic (IAD ≥10 and 20 mm Hg) and diastolic (IAD ≥10) prevalence: sequential measurements led to a significant higher prevalence than simultaneous measurements (RR ranges from 2.4 to 4.6), the use of a manual BP device led to a significant higher prevalence than when using an automated device (RR ranges from 2.2 to 4.2). However, there was a strong relationship between devices and measurement methods: all, except one, simultaneous measurements were performed with automated devices.

**DISCUSSION**

Various other factors, such as age and sex, also influence a person's blood pressure. In children, the normal ranges are lower than for adults and depend on height. Reference blood pressure values have been developed for children in different countries, based on the distribution of blood pressure in children of these countries. As adults age, systolic pressure tends to rise and diastolic pressure tends to fall. Consequently, in the elderly, systolic blood pressure often exceeds the normal adult range, this is thought to be due to increased stiffness of the arteries.<sup>6</sup> The present study was conducted to investigating the influence of methodology of BP measurement on the IAD value.

In present study, males were 680 and females were 560. In our study, we observed differences between groups separated for measurement methods device and the number of readings used to determine IAD prevalence's. The method of IAD performance had a significant influence on systolic (IAD ≥10 and 20 mm Hg) and diastolic (IAD ≥10) prevalence: sequential measurements led to a significant higher prevalence than simultaneous measurements, the use of a manual BP device led to a significant higher prevalence than when using an automated device. This is in agreement with Perloff et al.<sup>7</sup>

Differences between left and right arm blood pressure measurements tend to be small. However, occasionally there is a consistent difference greater than 10 mmHg which may need further investigation, e.g. for obstructive arterial disease. Arterial hypertension can be an indicator of other problems and may have long-term adverse effects. Sometimes it can be an acute problem, for example hypertensive emergency.<sup>8</sup> Levels of arterial pressure put mechanical stress on the arterial walls. Higher pressures increase heart workload and progression of unhealthy tissue growth (atheroma) that develops within the walls of arteries. The higher the pressure, the more stress that is present and the more atheroma tend to progress and the heart muscle tends to thicken, enlarge and become weaker over time.

**Table I** Distribution of subjects

Total - 1240		
Males	Females	P value
680	560	0.1

**Table II** Differences in prevalence inter-arm difference (IAD) between groups divided by measurements, device and number of readings

	Overall mean (95% CI)	Measurements RR: Seq/Sim	P	Device RR: Man/Auto	P	Readings RR: 1/≥2	P
<b>Systolic</b>							
IAD ≥10 mm Hg (%)	13.4	2.4	<0.01	2.2	<0.01	2.2	<0.05
IAD ≥20 mm Hg (%)	4.0	4.6	<0.04	4.2	<0.05	4.6	<0.01
<b>Diastolic</b>							
IAD ≥10 mm Hg (%)	6.4	2.4	<0.04	3.6	<0.02	4	<0.01
IAD ≥20 mm Hg (%)	0.6	0.6	<0.4	17.2	<0.4	-	-

Persistent hypertension is one of the risk factors for strokes, heart attacks, heart failure and arterial aneurysms, and is the leading cause of chronic kidney failure. Even moderate elevation of arterial pressure leads to shortened life expectancy. At severely high pressures, mean arterial pressures 50% or more above average, a person can expect to live no more than a few years unless appropriately treated.<sup>9</sup>

### CONCLUSION

Method used for blood pressure evaluation has major influence on IAD differences. Blood pressure should be measured in both the arms to prevent overestimation and observer bias with one or two automatic devices and multiple readings should be taken.

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**Source of support:** Nil

**Conflict of interest:** None declared

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