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Research Article

Comparison of Blood Pressure measurements taken by one stage approach, two stage approach and digital apparatus

Abstract

Mercury sphygmomanometers was developed over 100 years ago and largely unchanged since used in both hospital and ambulatory settings and considered as gold standard device for accurate blood pressure measurements. Blood pressure is important diagnostic index for circulatory function. If Blood pressure is abnormally low or high, it usually indicates greater health problem exist i.e. heart disease or stroke. So the aim of study was to compare blood pressure recordings taken with one stage approach, two stage approach and digital BP measurements among Healthy people. It was a survey approach and comparison design study were conducted and study protocol was approved by Institutional Ethics Committee. Healthy people were enrolled with total enumeration technique. Total 131 healthy people BP measurements taken with one stage, two stage approach and digital BP apparatus. Mean and SD of systolic (66.27±6.9) and diastolic (107.92±9.4) BP measurement obtained by one stage approach was similar to measurement obtained by digital BP apparatus whereas Mean & SD of systolic (55.15±6.71) and diastolic (103.52±9.23) BP measurement obtained by two stage approach are different. Systolic & Diastolic BP measurement taken by one stage approach and digital BP apparatus were similar and interchangeable and with two stage approach measured significant difference indicate measurement may not be accurate.

Introduction

Mercury sphygmomanometer are simple design and consist of a column of mercury connected by rubber tubing to a normally inflated cuff. Blood pressure readings are taken by auscultatory technique using Korotkoff sounds I & V to identify systolic and diastolic BP readings. In 1905 Nikolai Korotkoff introduce this auscultatory technique [1].

Blood pressure is pressure exerted by circulating blood upon the wall of blood vessels and is one of the principle vital sign. The maximum blood pressure is exerted on the walls of the arteries during ventricular contraction, when blood is pushed to aorta through aortic valve is called Systolic pressure. The minimum pressure exerted on the arterial wall during ventricular relaxation is called Diastolic pressure. The difference between systolic and diastolic pressure is called Pulse pressure [2].

As blood pressure measurement is recognized as most common clinical procedure. Nurses, physicians, medical students and nursing students used it on every patient to measure BP frequently, it is an easy and simple procedure. Literature confirm that there are deficiencies in teaching and performance of BP measurement by nurses, physicians, medical students and nursing students [3].

As there are two method of assessment of Blood pressure i.e. Direct method and Indirect method. Direct method in which arterial BP is most accurately measured by invasive through arterial line. Invasive arterial pressure measurement with intravascular cannula placed in artery usually in radial, brachial, dorsal pedis or femoral artery. Indirect method involve auscultatory, Oscillometric or palpation methods. Indirect method are simple and quicker than direct method and require less expertise, less unpleasant and less painful for the patients [3].

A study conducted (2006) on comparison of two methods of BP measurement stated that in current practice, two stage approach to measure BP has been widely accepted as the most accurate and reliable method. However, by changing the local hemodynamics, this procedure might after the blood pressure. In this study total 39 samples blood pressure was measured

using two indirect methods including both, two stage and one stage approaches. Mean systolic BP using the two stage approach was 110 mm of Hg, compared to 114 mm of Hg for the one stage approach. The results represents on average of 3.5 percent lower value when two stage approach was used. Results showed no statistically significant difference in values for systolic BP obtained from the two methods. However mean diastolic BP by using two stage approach was 65 mm of Hg, compared to 76 mm of Hg for the one stage approach. Statistically significant lower diastolic BP values were obtained using the two stage compared to the one stage approach. It was a proposed theory from this article that initial inflation of cuff to estimate systolic BP in the two stage approach might lead to reactive hyperemia and therefore a lower diastolic value. So this two stage approach might not provide the accurate readings as it claims and in addition it requires more time & subjects the patient to longer periods of stress [4].

On basis for this study comparison of one stage approach with two stage approach done to measure BP readings and to determine whether the different methods produce the same results and to make blood pressure measurement techniques more powerful and evidenced based.

Steps for Manual BP measurement by two stage approach are:

Step 1-Choose the right equipment i.e. a quality stethoscope and appropriate size BP cuff and BP measurement instrument. Step 2- Prepare the patient in supine position and allowing relaxed for 3 minute. Step 3- Choose the proper BP cuff size. Step 4- Place the BP cuff on patient's arm. Step 5- Position the stethoscope at ante cubical fossa. Step 6- Inflate the BP cuff. Step 7- Slowly deflate the BP cuff and palpate radial artery with fingertip of one hand at which pulse appearance is estimated systolic BP. Step 8- Reinflate the cuff 20 mm of Hg above estimated systolic BP. Step 9- Slowly deflate the BP cuff Listen for the systolic reading. Step 10- Listen for diastolic reading. Step 11- Double check for accuracy [5].

Steps for Manual BP measurement by one stage approach are:

Step 1-Choose the right equipment i.e. a quality stethoscope and appropriate size BP cuff and BP measurement instrument. Step 2- Prepare the patient in supine position and allowing relaxed for 3 minute. Step 3- Choose the proper BP cuff size. Step 4- Place the BP cuff on patient's arm. Step 5- Position the stethoscope at ante cubical fossa. Step 6- Inflate the BP cuff. Step 7- Slowly deflate the BP cuff. Step 8- Listen for the systolic reading. Step 9- Listen for diastolic reading. Step 10- Double check for accuracy

Objectives

The aim of the study was to do comparison of Blood pressure measurement taken by one stage approach, two stage approach and digital BP apparatus among healthy people.

Material & Methods

It was a survey approach and comparison study conducted in Maharishi Markandeshwar University, Mullana, Ambala from Nov 2010 to Dec 2010and study protocol was approved by Institutional Ethics Committee. Healthy people of Maharishi Markandeshwar University were enrolled with total enumeration technique.

Inclusion Criteria: Healthy people between age group from 17-35 years and who are available & willing to participate during data collection period.

Sample size estimation: $n = Z^2 (p \times q) \div c^2$ Where n is sample size, Z value= 1.96 for 95% confidence level p(percentage of population to be taken from previous study)= 0.95, q(1-p)= 0.05, c(confidence interval)= 0.01, Therefore $n = 1.96^2 (0.95 \times 0.05) \div 0.05^2 = 72$. Appropriate sample were taken from 131 healthy people satisfying inclusion criteria set beforehand. After selected the study subjects, BP was measured by placing the subject in supine position and kept in rest for 3 minute and first measurement of BP was done using one stage approach, then at 10 minute again measurement of BP was done with two stage approach and at 20 minute using digital BP apparatus measurement of BP was done and for three consecutive days BP was measured by altering the sequence of approaches of BP measurement. Statistical analysis of data was performed using unpaired t test P<0.05 was considered as significant.

Results

Among 131 healthy people BP was reported as Mean & SD of systolic and diastolic BP measured with three approaches.

Mean and SD of systolic BP and diastolic BP by one stage approach were similar and interchangeable with measurement obtained by digital BP apparatus whereas mean and SD of systolic BP and diastolic BP measured by two stage approach was dissimilar to readings obtained either by one stage approach or digital BP apparatus as shown in table 1.

T value shows difference between mean systolic BP taken with one stage approach and two stage approach is true difference and not by chance so measurement taken by two stage approach may not be accurate so one stage approach can be used successfully to got accurate systolic BP measurements as shown in table 2. T value shows difference between mean diastolic BP taken with one stage approach and two stage approach is true difference and not by chance so measurement taken by two stage approach may not be accurate so one stage approach can be used successfully to got accurate systolic BP measurements as shown in table 3.

T value showed difference between mean of pulse pressure of one stage approach and two stage approach as well as mean

Table 1: Mean & SD of systolic and diastolic BP measurements.

| Approach of BP | Systolic BP | | N=131 | |
| | | | Diastolic BP | |
	Mean	SD	Mean	SD
One stage approach	107.92	9.4	66.27	6.9
Two stage approach	103.52	9.23	59.15	6.71
Digital BP apparatus	107.92	9.4	66.27	6.9

of pulse pressure of digital BP apparatus was a true difference and statistically significant table 4.

Table 2: t value showing difference of systolic BP measurements between one stage approach, two stage approach and digital BP apparatus.

Approach	Mean	Mean difference	SD$_D$	t value
			N=131	
One stage approach Two stage approach	107.92 103.52	4.4	88.5	3.83*
One stage approach Digital BP apparatus	107.92 107.92	0	0	Not tested
Two stage approach Digital BP apparatus	103.52 107.92	-4.4	88.5	3.83*

Table 3: t value showing difference of diastolic BP measurements between one stage approach, two stage approach and digital BP apparatus.

Approach	Mean	Mean difference	SD$_D$	t valve
			N=131	
One stage approach Two stage approach	66.27 59.15	7.12	45.72	8.58*
One stage approach Digital BP apparatus	66.27 66.27	0.00	0.00	Not tested
Two stage approach Digital BP apparatus	59.15 66.27	-7.12	45.72	8.58*

Table 4: t value showing difference of pulse pressure between one stage approach, two stage approach and digital BP apparatus.

Approach of BP measurements	Mean	Mean Difference	S.D.$_D$	S.E. MD	t value
					N=131
One stage approach Digital BP apparatus	41.64 41.64	0.00	84.43	1.13	0. 00$_{NS}$
Two stage approach Digital BP apparatus	44.37 41.64	2.73	52.28	0.89	3.07*
One stage approach Two stage approach	41.64 44.37	-2.73	52.28	0.89	3.07*

Discussion

Nursing as a main branch of health care system has made great strides. Nurse should be trained and tuned to new procedures. As Early detection and treatment of high BP reduces incidence of stroke, heart attack and heart failure. So accurate blood pressure measurement with advance and evidenced based procedures will identify person who as at risk and expose normotensive person to unnecessary treatment [6].

By using validated and calibrated blood pressure

instrument, researcher recorded blood pressure with one stage approach, two stage approach and digital BP apparatus and findings revealed that BP measurement taken by one stage approach and digital BP apparatus were found similar hence can be used interchangeably. So one stage approach provided more accurate readings, it requires less time and subject the person to lessen period of stress. Measuring and recording vital signs i.e. BP correctly is important as this give an indication of patient's physiological state [7].

Conclusion

The study revealed that systolic and diastolic BP measurements taken by one stage approach and digital BP apparatus were almost similar and hence can be used interchangeably and difference in systolic and diastolic BP measurement among one stage approach and two stage approach being significant indicate that measurement taken by two stage approach may not be accurate so one stage approach is preferable approach over two stage approach for assessment of BP among patients.

Acknowledgement

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