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A COMPARATIVE STUDY ON BLOOD PRESSURE AND PULSE RATE USING CONVENTIONAL AND DIGITAL METHODS IN PHASE I MBBS STUDENTS

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ABSTRACT Mercury sphygmomanometer has been used as the golden standard for measuring blood pressure and three finger method for pulse rate. As digital devices are widely used these days for the estimation of the Blood pressure and pulse rate, this study was carried out to find out whether any significant difference in the readings for the measurement of blood pressure and pulse rate using digital method and conventional method. Study included 96 Phase I MBBS students. In conventional method blood pressure was recorded by using mercury sphygmomanometer and radial pulse by three finger method. Blood pressure and Pulse rate were recorded simultaneously using fully automatic /digital blood pressure monitor. The difference in systolic blood pressures by both methods was found to be significant (p value 0.000). The difference in diastolic blood pressures by both methods was also found to be significant (p value 0.001). The mean pulse rate by conventional method and digital method was found to be significant (p value 0.000). As there was significant difference in systolic and diastolic blood pressure between the mercuric sphygmomanometer and digital device , digital devices should be restricted to home monitoring or where there is deficiency of the trained personal to measure blood pressure. If it has to be used in the clinical setting for diagnostic or monitoring purposes, it should be used with utmost caution.

KEYWORDS : Mercury sphygmomanometer, Digital , Blood pressure, Radial pulse

INTRODUCTION

Blood pressure, Pulse rate, Respiratory rate and temperature are among the main vital signs routinely monitored and this give a measure of body's most basic functions. Blood pressure and Pulse rate and have become important not only as health indicators, but also to provide awareness to people. Blood pressure measurement helps in early diagnosis and management of hypertension thereby decreasing the complications such as heart failure, myocardial infarction, strokes and mortality. According to WHO reports in 2015, the global prevalence of hypertension was more than 1.1 billion[1]. It has been estimated that there is approximately 25% increase in the chances of developing fatal stroke and fatal myocardial infarction for 5mmHg rise in systolic blood pressure [2]

The Global Burden of Disease study in 2017 found raised systolic blood pressure as the leading modifiable risk factor for death worldwide, with 10.4 million deaths annually attributed to this cause[3] .Similarly pulse rate or heart rate, not only gives an idea about basic functioning of heart, but also in stress evaluation and load adjustment during exercise and training especially in sports persons.

For more than ten decades, the gold standard for noninvasive method of measuring blood pressure is the mercury sphygmomanometer [4]. Conventionally three finger method is used for measurement of pulse rate. In clinical settings digital devices are slowly gaining wider acceptance. Due to its relative ease of use as it does not require the auscultation skill, it is the preferred choice for personal monitoring as home blood pressure monitors. Digital sphygmomanometers measures the oscillations of the arteries during inflation and deflation of the cuff , using pressure sensors and then process them using an algorithm to produce systolic & diastolic values and heart rate that are digitally displayed on the device display.

Many studies are carried out from different parts of the world to find out the differences in blood pressure recording using different types of instruments [5,6]. Pulse rate is recorded usually by conventional methods , electronic measurement by means of electrocardiogram , optical measurements / photoplethysmography using devices like pulse oxymeter , smart watches and fitness wrist bands [7,8,9] .

In this study we have attempted to find out if there any significant differences in the blood pressure and pulse rate using conventional methods and digital methods with the commonly available instruments in our research set up.

MATERIALS AND METHODS

The study was carried out in the physiology clinical laboratory of Azeezia Institute of medical sciences and research , Kollam , Kerala from march to April 2023 .

Inclusion Criteria

Phase I MBBS students who are willing to participate in the study

Exclusion Criteria

Those with hypertension, renal disease or any other systemic illness

96 students participated in the study. After explaining the procedure and obtaining informed consent from all the participants , weight was measured in kilograms using standard weighing machine. Height in centimeters was measured using a measuring tape with the person standing against wall. It was ensured that the participants were relaxed for minimum 10 -15 minutes before starting measurements. First radial Pulse was recorded by conventional three finger method. Then blood pressure was recorded in the right upper limb in the sitting posture using mercury sphygmomanometer (Diamond mercurial BP apparatus - deluxe) . After an interval of 10 minutes, recording was done on the same limb by digital method. By digital method , pulse rate and blood pressure were recorded simultaneously using 'S.Cure' arm type fully automatic blood pressure monitor (Model no. DG 4111) . The same person was taking blood pressure measurements by mercury sphygmomanometer for all and another person by digital method so that individual variation in measurement will not be there .The person taking measurements with one method was not aware of the reading by another method. All the measurements were taken from 2 to 4 pm in the afternoon. Pulse pressure was found out by subtracting diastolic blood pressure (DBP) from systolic blood pressure (SBP). Mean arterial pressure (MAP) was calculated by formula DBP + 1/3 pulse pressure . After entering the data in Microsoft excel sheet, statistical analysis was done using SPSS 20 software. Mean and standard deviation was found out and paired t test is used for analysis and p value 0.05 was taken as statistically significant.

RESULTS

Mean age of the participants was 19.89+/-1.221years , height in meters 1.59+/- 0.082, weight in kgs 58.91+/-12.651 and mean BMI was 22.92 +/- 3.782 . The mean systolic blood pressure in mmHg using mercury sphygmomanometer was 112.21+/- 10.513 and by digital method was

119.19+/- 11.870 (difference in mean value of 6.98 +/-8.897. The difference in systolic blood pressures by both methods was found to be significant (p value 0.000). The mean diastolic blood pressure by mercury sphygmomanometer was 76.10+/-7.564mmHg and by digital method was 73.49+/-8.496mmHg (difference in mean value of 2.615 +/- 7.513. The difference in diastolic blood pressures by both methods was also found to be significant (p value 0.001) (figure1).

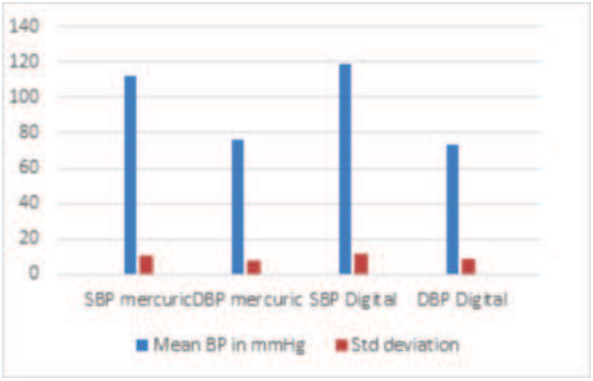

Figure 1 . Blood Pressure by Conventional & Digital Methods

The mean pulse rate by conventional method was 88.19+/-8.67 and by digital method was 95.64 +/- 14.69 and was found to be significant (p value 0.000)(figure 2).

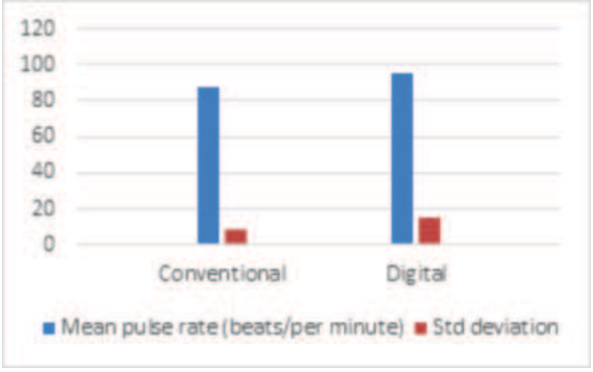

Figure 2. Pulse Rate by Conventional & Digital Methods

The mean pulse pressure using mercuric device was 36.1+/-9.92 and digital device was 45.7+/-8.03 and it was found to be statistically significant (p<0.001) . The mean arterial pressure (MAP) in mmHg was found to be 88.1+/-7.29 with mercuric type and 88.7+/-8.99 with digital device and it was not significant (p 0.398) .

DISCUSSION

Accurate measurement of blood pressure helps in identifying and managing persons with hypertension which is a modifiable risk factor for cardiovascular disease, stroke, chronic renal disease , maternal and fetal deaths etc . The conventional mercury type of sphygmomanometers, aneroid type and the digital or the automated devices are the commonly used instruments. WHO has given guidance to countries regarding phasing out mercury-containing sphygmomanometers in the health care sector in the context of the Minamata Convention on Mercury[10]. Mercury evaporates readily into the atmosphere, which can result in breathing air containing elemental mercury vapors, which can have harmful effects on the nervous, digestive and immune systems and the lungs and kidneys. The Convention's established date for phasing out the manufacture, export or import of mercury-containing sphygmomanometers and thermometers was 2020, but exemptions given up to 2030 11 . Digital devises give the results automatically, easy to carry and measure even by an unskilled person , it is highly useful in remote areas where medical facilities are less and also for regular monitoring at home .

In this study we tried to find out whether there is any difference between the readings of mercury type and the digital or automated ones which is commonly available in our research set up. The systolic blood pressure using digital device was more when compared to mercuric device whereas the diastolic blood pressure was less in digital device when compared to mercuric device . The differences in systolic and diastolic blood pressures by both methods were found to be significant. In a study conducted by Bhatt etal comparing measurements using mercury, aneroid and automated types showed significant difference in systolic blood pressure[6] . Gokhale etal in their study using mercury and automated devices conducted in 2019 also observed significant difference for systolic , diastolic and mean blood pressure by both methods [12] . In another study conducted in clinical settings also revealed a significant difference between the blood pressures obtained by manual and digital methods[13] .Whereas in a study by Wadhwani etal , the blood pressure readings were comparable by both methods even though digital device gives slightly higher values of systolic blood pressure [14]. In a study by Anita S , there was no significant difference between the systolic and diastolic blood pressure between the two instruments [15] . In the present study , the mean pulse rate using digital method was high when compared the pulse rate obtained by conventional three finger method and it was found to be statistically significant which indicates that the values were not comparable. It can only be used during home monitoring as a rough indicator of pulse rate and cannot rely completely on those values.

Limitations

As the study was conducted in young students of a single institution using one each of 2 types of instruments , the results cannot be generalized . Studies in larger population of different age groups with instruments from different makers are required in this regard.

CONCLUSION

The use of digital sphygmomanometers should be restricted to home monitoring or where there is deficiency of the trained personal to measure blood pressure . If it has to be used in the clinical setting for diagnosis of hypertension or monitoring in hypertensive or hypotensive individuals , it should be used with utmost caution .

Conflicts Of Interest– Nil

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