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A Comparative Study between Digital, Aneroid and Mercury Sphygmomanometers

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Abstract: ***This study evaluates the accuracy of digital and aneroid sphygmomanometers compared to the traditional mercury sphygmomanometers, with a focus on potential replacements that are less harmful to the environment. Conducted in a multispeciality hospital in Ahmedabad, India, over a one - month period, the research involved 101 non - hypertensive individuals aged 18 to 30 years. Measurements were taken using all three types of sphygmomanometers, and the data analyzed using SPSS software. The findings indicate no significant difference in mean systolic blood pressure measurements across the devices, while the differences in mean diastolic measurements were significant between mercury and digital, and highly significant between mercury and aneroid sphygmomanometers. The study concludes that with regular calibration against a mercury standard, both digital and aneroid devices can serve as viable, environmentally friendly alternatives for blood pressure measurement in community settings.***

Keywords: Hypertension, Sphygmomanometer, Blood Pressure Measurement, Digital Device, Aneroid Device

1. Introduction

Hypertension is one of the major public health problems affecting the whole world. So, accurate measurement of blood pressure is of utmost importance for early diagnosis of hypertension as well as preventive management of cardiovascular diseases and stroke. Blood pressure might be measured with several modalities: mercury, digital, and aneroid sphygmomanometer. The mercury sphygmomanometer has been the gold standard for blood pressure measurement. Mercury, however, is a potent human neurotoxin. An international effort has developed to eliminate health - care sources of mercury - - the thermometer and sphygmomanometer - - and replace them with less toxic alternatives.

In a large study at this outset in UK examined the comparability of measurement accuracy of all the three categories of sphygmomanometer and found that aneroid and digital instruments are almost as accurate as mercury instruments. However, such evidences are scanty in Indian context, where there is an obvious need of more feasible and inexpensive instruments because of large population size, increased poverty and decreased tendency to seek institution based medical care.

Thus, our study was conducted with the aim to check the accuracy of digital and aneroid sphygmomanometers with that of mercury sphygmomanometers. If the gap is not much than we can use non mercury devices in communities because mercury devices have certain issues related to environment, portability and expense.

2. Methods

The study was conducted at a multispeciality hospital in Ahmedabad for a duration of one month (29 - 3 - 23 to 30 - 4 - 23), after approval by the Institutional Scientific & Ethics Committee. It is a Cross sectional based analytical study. A total of 101 non hypertensive individuals between age group of 18 to 30 years, irrespective of gender were included in the study.

Blood pressure was measured with three types of Sphygmomanometers using auscultatory method in the same setting and recorded

a) Digital Sphygmomanometer (Omron HEM - 8712)
b) Aneroid Sphygmomanometer
c) Mercury Sphygmomanometer (Diamond (BMR - 112)),

All the data were incorporated in single excel sheet and statistical analysis was done using SPSS software.

3. Results

Table 1: Age and Gender Distribution

		No.	%
Age	<30	25	24.75
	30 - 50	51	50.5
	50 - 70	20	19.8
	70 - 90	4	3.96
	≥90	1	0.99
Gender	Male	43	42.57
	Female	58	57.43

Table 2: Difference in mean Systolic BP by Mercury and Aneroid Sphygmomanometer

	Mean Systolic BP	SD	Independent t test p value
Mercury	126.46	22.41	0.066
Digital	120.67	22.11	

Table 3: Difference in mean Systolic BP by Mercury and Digital Sphygmomanometer

	Mean Diastolic BP	SD	Independent t test p value
Mercury	126.46	22.41	0.558
Digital	128.38	24.08	

Table 4: Difference in mean Diastolic BP by Mercury and Aneroid Sphygmomanometer

	Mean Diastolic BP	SD	Independent t test p value
Mercury	85.50	13.31	<0.0001
Digital	78.15	13.38	

Table 4: Difference in mean Diastolic BP by Mercury and Digital Sphygmomanometer

	Mean Diastolic BP	SD	Independent t test p value
Mercury	85.50	13.31	0.05
Digital	81.73	13.80	

It can be interpreted that the difference between the mean systolic BP was not significant between Digital, Aneroid and Mercury Sphygmomanometer. Whereas, in case of Diastolic BP, the difference in mean was significant between Mercury & Digital and highly significant between Mercury & Aneroid Sphygmomanometer.

4. Conclusion

Although mercury column sphygmomanometer has remained the gold standard for measurement of blood pressure measurement over the years, there are concerns about the environmental toxicity of mercury. Aneroid sphygmomanometers provide accurate pressure measurements when a proper maintenance protocol is followed.

The aneroid device had better accuracy than the digital device as per earlier studies.

Keeping in view the accuracy of the three types of Sphygmomanometers, we can conclude that Mercury Sphygmomanometers can be replaced by Digital and aneroid Sphygmomanometers in Community settings with the condition that digital and aneroid will have to be calibrated against a Mercury Sphygmomanometer at regular intervals.

All three devices showed variable performance. They should be validated before purchase and calibrated on a regular basis.

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