Comparison between Blood Pressure Readings of Mercury Sphygmomanometer versus Non-Mercury Sphygmomanometers

Areebah Qadir, Mohammad Raza Khan
Bakhtawar Amin Medical and Dental College, Multan, Pakistan

ABSTRACT

Background: Previous studies showing levels of inaccuracy in the readings by aneroid and digital sphygmomanometers used in clinical settings

Aim: establishing the type and accuracy of mercury free sphygmomanometers

Method: Readings from an aneroid and a digital device were compared to readings from a properly calibrated mercury sphygmomanometer. Data was collected from 120 people all who were above 25 years of age. Two readings were taken from each sphygmomanometer.

Results: Results from 120 test subjects showed that the mean difference between the readings from the mercury and aneroid device was less than the difference between readings from the mercury and digital device for both systolic and diastolic pressures. More than 71% of aneroid readings had an absolute difference of 5mm Hg whereas less than 35% of digital readings

Summary

The mercury sphygmomanometer has been the gold standard for accurately estimating BP in a non-invasive setting for over a century but in light of the recent concern worldwide over the potential toxicity of mercury and its effects, there has been a decrease in the use of the Mercury instruments and this study is aimed at validating the use of aneroid and digital sphygmomanometer in comparison with Mercury sphygmomanometer for monitoring blood pressure. This showed that aneroid devices were more efficient instruments than digital devices in classifying individuals as hypertensive or normotensives

This was a cross-sectional study conducted clinically to figure out the accuracy of the 3 categories of sphygmomanometer, readings from an aneroid and a digital device were compared to readings from a properly calibrated mercury sphygmomanometer. Data was collected from 120 people all who were above 25 years of age. With our study we were able to differentiate between the accuracy of aneroid and digital sphygmomanometer and have established that aneroid sphygmomanometers are more effective than digital sphygmomanometers in measuring blood pressure in a clinical setting.

We calculated the sensitivity of aneroid and digital devices whilst considering the mercury device gold standard, and statistical analysis of the data collected showed that aneroid sphygmomanometer have high sensitivity (52.0%) whereas digital sphygmomanometer have a comparatively low sensitivity of (13.4%). When comparing the measurements of blood pressure in our study the absolute difference of 5 mm Hg between mercury and aneroid device was 71.3% and 74.1% for systolic and diastolic blood pressure respectively, whereas the absolute difference of 5 mm Hg between mercury and digital device was 23.1% and 34.5% for systolic and diastolic blood pressure respectively.

In our study we have come to the conclusion that aneroid devices are a great mercury free alternative that can be used to measure blood pressure in clinical settings.

We calculated the sensitivity of aneroid and digital devices whilst considering the mercury device gold standard, and statistical analysis of the data collected showed that aneroid sphygmomanometer have high sensitivity (52.0%) whereas digital sphygmomanometer have a comparatively low sensitivity of (13.4%). When comparing the measurements of blood pressure in our study the absolute difference of 5 mm Hg between mercury and aneroid device was 71.3% and 74.1% for systolic and diastolic blood pressure respectively, whereas the absolute difference of 5 mm Hg between mercury and digital device was 23.1% and 34.5% for systolic and diastolic blood pressure respectively.

In our study we have come to the conclusion that aneroid devices are a great mercury free alternative that can be used to measure blood pressure in clinical settings.
had an absolute difference of 5mm Hg, when they were compared to readings from mercury device.

**Conclusion:** Aneroid devices were seen to be significantly more accurate than digital devices, when compared to mercury sphygmomanometer.

**Introduction**

Globally hypertension is one of the major risk factors leading to cardiovascular diseases and ultimately death. Along with increasing the risk for coronary heart disease and ischemic and hemorrhagic stroke it also causes cardiac hypertrophy, heart failure, peripheral vascular disease, renal failure, retinal hemorrhage and visual impairment [1]. Hypertension usually remains asymptomatic until late in its course and hence. Its diagnosis and control require accurate blood pressure measurement. Accurately measuring the blood pressure depends on both the instrument and technique used. [2]

The mercury sphygmomanometer has been the gold standard for accurately estimating BP in a non-invasive setting for over a century but in light of the recent concern worldwide over the potential toxicity of mercury and its effects, there has been a decrease in the use of the Mercury instruments and are being replaced with mercury-free alternatives such as aneroid and digital sphygmomanometers [1]

This study is aimed at validating the use of aneroid and digital sphygmomanometer in comparison with Mercury sphygmomanometer for monitoring blood pressure.

**Materials and methods**

This was a cross-sectional study conducted clinically to figure out the accuracy of the 3 categories of sphygmomanometer at Bakhtawar Amin Memorial Trust Hospital. This study was performed on people over 25 years of age as most individuals encountered in the outpatient department (OPD) less than 25 years of age were not hypertensive. The total participants of this study were 120. Each individual’s blood pressure readings were taken by 3 types of sphygmomanometers; mercury sphygmomanometer (ALPK2), aneroid sphygmomanometer (CR-1004) and digital sphygmomanometer (Omron M2), all were calibrated by experts.

It was made sure that the study participants were relaxed 10-15 min prior to taking measurements; they were seated comfortably with legs uncrossed and arm supported at heart level. Appropriate sized cuffs were used and measurements were taken twice with each sphygmomanometer, with the average of the 2 readings being recorded. A 60 second interval was observed between all blood pressure readings.

**Results**

The readings from aneroid and digital device were compared to the readings of mercury device. The mean age of the participants studied was 50 years.

When comparing the measurements of blood pressure in our study the absolute difference of 5 mm Hg between mercury and aneroid device was 71.3% and 74.1% for systolic and diastolic blood pressure respectively, whereas the absolute difference of 5 mm Hg between mercury and digital device was 23.1% and 34.5% for systolic and diastolic blood pressure respectively.

The sphygmomanometers were also evaluated on the basis of classifying the patients as hypertensive or non-hypertensive. A mercury device reading of 140/90 mm Hg was used as a diagnosing tool for individuals. The aneroid device correctly diagnosed 93.3% hypertensives and 95% normotensives while the digital device correctly diagnosed 81.2% hypertensive and 70.1% normotensives.

**Discussion**

We conducted this study to determine the accuracy of aneroid and digital sphygmomanometers by comparing it to the gold standard, Mercury sphygmomanometer. We wanted to evaluate the accuracy of the mercury free alternatives in terms of measuring blood pressure and helping in diagnosing hypertensive correctly and efficiently in a clinical setting.

We found that aneroid and mercury showed good agreement (kappa= 0.78. p<0.001) but the agreement between digital and mercury was moderate (kappa= 0.391, p<0.001) in classifying hypertension. This showed that aneroid devices were more efficient instruments than digital devices in classifying individuals as hypertensive or normotensives

We calculated the sensitivity of aneroid and digital devices whilst considering the mercury device gold standard, and statistical analysis of the data collected showed that aneroid sphygmomanometer have high sensitivity (52.0%) whereas digital sphygmomanometer have a comparatively low sensitivity of (13.4%). The specificity and positive and negative predictive values were also calculated in the same manner, and all indicators showed that the aneroid device performed better and gave better results in comparison to the digital device.

With our study we were able to differentiate between the accuracy of aneroid and digital sphygmomanometer and have established that aneroid sphygmomanometers are more effective than digital sphygmomanometers in measuring blood pressure in a clinical setting.
Conclusion

In our study we have come to the conclusion that aneroid devices are a great mercury free alternative that can be used to measure blood pressure in clinical settings.

This research is to make community aware of the fact that though the up and coming digital devices are easy to use requiring no expertise, they are not as accurate as its counter parts and can lead to individuals being wrongly diagnosed. Hence we strongly oppose their use in clinical settings by health professional and believe that aneroid sphygmomanometers are much better and effective alternatives.

References
