Mercury Sphygmomanometers Should Not be Abandoned: An Advisory Statement From the Council for High Blood Pressure Research, American Heart Association

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In healthcare institutions around this country and around the world, mercury sphygmomanometers are being removed. In many situations, the decision to replace the instruments is being made without significant input from involved clinicians or consideration of the health risks that will follow if they are replaced by less accurate devices.

Blood pressure measurement is an important indicator of the current clinical condition of patients and a powerful predictor of future cardiovascular and overall health. Blood pressure measurement is often considered "routine" and is often performed by those with the least training. In many institutions, blood pressure measurement is a low priority, with less than ideal quality control related to equipment selection, equipment calibration and repair, and personnel training and performance.

For more than a century, the mercury gravity sphygmomanometer has been the gold standard for indirect measurement of blood pressure. Indeed, the world primary standard for pressure measurement is a mercury manometer. It is a simple, gravity-based unit with easy calibration, infrequent need for repair, and it has been validated in many clinical circumstances against direct intra-arterial blood pressure measurement.

In recent years, these mercury units have been replaced with aneroid instruments in many institutions and more recently with electronic manometers. Justifications for the replacement of mercury manometers have included concerns about the safety of mercury, concerns about regulations regarding the use of mercury in the workplace, and attempts to eliminate human error involved in the reading of measurements. An examination of the evidence around these concerns is necessary before clinicians contribute actively or passively to the replacement of these instruments.

Are mercury manometers dangerous to use in hospital and other clinical settings? Accidental exposure to mercury from sphygmomanometers used in healthcare settings is extremely rare. It is true that there have been a few isolated instances of illness in children from mercury toxicity related to broken elemental mercury-containing instruments used in homes. Most of these occurrences have been related to broken glass thermometers. One detailed report has provided data suggesting that volatilized mercury, after spillage of mercury, produced reversible neurological symptoms. Nevertheless, modern mercury sphygmomanometers are available in models that prevent accidental spillage of mercury, which essentially eliminates the concern for this rare occurrence.

Is the use of mercury manometers forbidden by regulation in the United States? No. Most regulations related to mercury deal with mercury compounds, such as those used in the manufacture of some automobile batteries. The use of mercury manometers is presently restricted in only a handful of countries. None of the healthcare regulatory agencies in the United States, governmental or voluntary, forbid the use of mercury manometers. However, reports of loss of hospital accreditation in the United States (for whatever reasons) have prompted widespread concern. Notwithstanding, mercury instruments are approved and are legal devices in this country, and we believe they should remain so.

Are aneroid or electronic devices a reliable substitute for mercury manometers? There are 2 crucial issues to consider here: validation and calibration. Although both aneroid and electronic instruments have some advantages of portability and ease of use, few of these instruments have had adequate validation. Still fewer of these instruments are calibrated regularly. To be sure, these instruments have a place in patient management, particularly with respect to their use as home monitoring devices. However, most of these instruments have not been adequately validated over a wide range of blood pressures, ages, and clinical conditions to warrant routine use in hospitals and outpatient settings. What is of critical importance is that most manufacturers of aneroid and electronic instruments recommend calibration against a mercury manometer every 6 months. However, few hospitals and clinics have a regular program of evaluation and calibration. Most of these instruments cannot be calibrated without return to the manufacturer.

Can the use of electronic instruments eliminate human error in blood pressure determination? Certainly, a challenging aspect of human blood pressure determination with a mercury sphygmomanometer is the human error introduced with the hearing and recording of the Korotkoff sounds. Hearing impairment and digit preference are 2 major concerns. Electronic instruments do offer an advantage in this area but still leave ample room for other causes of human error in cuff size determination, placement of the cuff, etc. It
is apparent that all human error cannot be eliminated with electronic devices.

Is accurate blood pressure measurement really important? Obviously the answer is yes. Consistent overestimation of blood pressure in the population can be associated with costly overtreatment of hypertension. Consistent underestimation of blood pressure can cost many lives in failing to prevent cardiovascular disease through effective and safe therapy of hypertension.2

There is a constant need for caution in the selection of blood pressure measuring devices. New is not always better. Just as in the selection of medication for elevated blood pressure, evidence should guide our decisions. Sometimes, evidence presents us with unexpected outcomes. We encourage consideration of the same level of evidence in the selection of blood pressure measuring devices as in the selection of drugs and other medical instruments. Clinicians involved in the management of patients with blood pressure problems must accept the responsibility for ensuring adequate instruments are available. If we are passive much longer, the time to act effectively will be past.

Specifically, we recommend that clinicians educate themselves on the instruments available for use in their clinics and hospitals; engage in the process of selection of instruments through dialogue with administrators and through hospital committees; encourage the general use of mercury manometers as the instrument of choice until other instruments are better validated; where aneroid or electronic instruments are used, ensure that instruments are validated through the Association for the Advancement of Medical Instrumentation or a similar organization; ensure a program of regular maintenance and calibration of all instruments. In sites where aneroid or electronic instruments are used exclusively, if mercury instruments cannot be reintroduced for regular use, insist on the use of mercury instruments for calibration of aneroid and electronic instruments; ensure a regular training program for those who measure blood pressure; join the American Heart Association in encouraging studies to validate the safety and reliability of all instruments used for blood pressure determination; and use evidence in determining both safety and reliability of any instrument.

To these ends, the American Heart Association stands ready to relate with any and all organizations wishing to further explore this issue. Throughout 6 published editions on human sphygmomanometry for patients, the American Heart Association has presented updated information on this vital subject. We stand ready to consider any new views and data that are germane to the publication of our next report.

References