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Home blood pressure monitoring for detection and control of hypertension: a call for action

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A DEADLY EPIDEMIC

Over one billion people worldwide are afflicted with hypertension[1]. Prevalence of hypertension in Brazil varies depending on region, but ranges from 22% to 44%[2]. The impact of hypertension on morbidity and mortality is staggering. Hypertension increases the risk of left ventricular hypertrophy[3], triples the risk of stroke[4], and increases the risk of developing end-stage renal disease by fivefold[5]. Even high-normal blood pressure (BP) nearly triples the risk of major cardiovascular events[6]. In fact, for every 20/10 mmHg increase in systolic/diastolic BP above 115 x 75 mmHg, cardiovascular mortality doubles[7].

Hypertension remains the single factor responsible for the most deaths worldwide at over 7 million deaths annually[8]. In Brazil, deaths from cardiovascular disease have outnumbered all other causes of death for over forty years and accounts for almost 1/3 of all deaths[2]. Although great progress has been made in some areas of the world, mortality in Brazil from cerebrovascular and coronary artery disease has shown little improvement[2].

Given the scope of this global epidemic, it is astounding to discover that patients and physicians do a poor job diagnosing and managing the disease. In the United States, between 2003 and 2004, just over half of all hypertensive patients were even being treated for the disease and only 33% were controlled[9]. In Brazil, less than 25% of surveyed physicians even recognized a BP ≥ 140 x 90 mmHg as hypertensive and less than 20% attempt to achieve the Brazilian Guidelines on Hypertension[10].

Benefits from controlling hypertension have been unequivocally shown in multiple studies. Lower BP has been associated with slower loss of kidney function[11], patient survival in diabetics, myocardial infarction as well as all-cause mortality[6,12-14]. Treating hypertension has shown to lower the rate of GFR decline[15,16] and decrease several major cardiovascular events[17-21].

Hypertension is clearly a disease of great burden to society but one that can be effectively treated with resultant reduction in morbidity and mortality. Given the poor control status, improvements in diagnosing and managing this epidemic are needed. Improved management begins with correctly diagnosing the disease process at hand, which in turn requires familiarity with several conditions and definitions.

DEFINITIONS

The most common entity is that of combined systolic and diastolic hypertension, defined as a systolic/diastolic BP ≥ 140 x 90 mmHg by the Brazilian Guidelines on Hypertension (Table 1) and others[1,2,22].

Table 1. Classification of arterial blood pressure (> 18 years old) and guidelines for follow-up with maximum intervals, modified according to the patient's clinical status[18](B)

Classification	Systolic	Diastolic	Follow-up
Optimal	< 120	< 80	Re-evaluate in 1 year
Normal	< 130	< 85	Re-evaluate in 1 year
Borderline	130-139	85-89	Re-evaluate in 6 months*
Hypertension			
Stage 1 (mild)	140-159	90-99	Confirm in 2 months*
Stage 2 (moderate)	160-179	100-109	Confirm in 1 month*
Stage 3 (severe)	> 180	> 110	Immediate intervention or re-evaluate in 1 week*
Isolated systolic	> 140	< 90	

**When systolic and diastolic pressures are in different categories, the classification should follow the higher level encountered.*

Consider intervention according to major risk factors and comorbidities.

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Isolated systolic hypertension is defined as a systolic BP ≥ 140 mmHg with normal diastolic BP. Isolated diastolic hypertension has a diastolic BP ≥ 90 with normal systolic BP. Pseu-

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dohypertension has elevated BP as measured by external cuff with normal intra-arterial pressure and is thought to be due to calcification of the arteries resulting in decreased compressibility of vessels, thereby falsely elevating cuff measurements[23].

Difficulty arises with patients whose BP readings differ between office and out-of-office readings. White-coat hypertension (WCH) is defined as persistently high BP readings in the office with normal daytime or ambulatory blood pressure monitoring (ABPM) (generally < 135 x 85 mmHg). The prevalence of WCH has been shown to be as high as 20%[24-27]. Patients with WCH have been shown to have risk profiles similar to normotensive patients[24,25,27].

Alternatively, patients who are persistently hypertensive outside the doctor's office, with normal office-based readings are considered to have masked hypertension (MH). The prevalence of MH also varies based on the study, and has been shown to be as high as 40%[28,29]. The impact of MH is tremendous as it has been shown to carry the risk of target organ damage and clinical endpoints similar to those risks associated with sustained, uncontrolled hypertension[25,29-33].

Nocturnal, or nighttime changes in BP have been shown to be clinically significant as well. The Ohasama Study demonstrated that nighttime BP predicted cardiovascular mortality[34]. A decrease in nighttime BP by 10% - 15%, or "dipping", is normal and those patients who lack this phenomenon, or "non-dippers", have been shown to be at increased risk of cardiovascular events including stroke[26,35]. African Americans, the elderly, patients with chronic kidney disease (CKD), sleep apnea and diabetes mellitus have a higher prevalence of non-dipping. Correlates of non-dipping in patients with CKD include low glomerular filtration rate (GFR), proteinuria and lower serum albumin concentration[36]. In fact, in patients with CKD, non-dipping is associated with increased risk of total mortality and is an independent predictor of end-stage renal disease[37].

HOME BLOOD PRESSURE MONITORING

Given the impact out-of-office BP has on morbidity and mortality, it is imperative that we use this tool appropriately in our patients. In fact, evidence is building to support the use of home blood pressure monitoring (HBPM) for the diagnosis and management of hypertension. As inexpensive, commercially-available BP monitors become more widely available, health-care providers must involve their patients in the management of hypertension.

The standardized BP measurement is performed by trained personnel, using a mercury sphygmomanometer to determine Korotkoff sounds under controlled conditions[1]. Unfortunately, routine office measurements, performed hastily by untrained personnel with automatic, oscillometric devices are common and can be inappropriate for the diagnosis and management of hypertension. In fact, studies are accumulating that show home BP (HBP) measurements as prognostically superior to office-based measurements[38-42].

HBP correlates better with left ventricular hypertrophy when compared to office-based readings[43,44]. It has stronger prognostic value compared to office BP measurement[40-42]. HBP has a stronger relationship to overall and cardiovascular mortality compared to office-based, or screening, systolic BP[38]. It is similar in reliability compared to ABPM in predicting target-organ damage, is an independent predictor of hemorrhagic and ischemic stroke[45] and adequately predicts risk of death[39].

In addition, HBP monitoring has the ability to identify patients who have either MH or WCH[38,40,42,46-48]. As noted above, it has been shown that MH, which can be present in up to 40% of patients, carries with it the same risk as sustained, uncontrolled hypertension. This can account for a large number of patients that are exposed to cardio- and cerebrovascular events if only office-based BPM is performed.

Alternatively, up to 20% of patients can have WCH which does not increase patient risk for events. These patients will be unnecessarily treated with anti-hypertensives that will not only strain budgets directly but also add to the medical and financial burden with respect to drug side effects, unnecessary polypharmacy and adverse events.

ABPM is continuous 24-hour monitoring of a patients BP with an automated device. It typically checks BP every 20-30 minutes and allows for analysis of BP over a prolonged period including the sleep cycle or night-time. It is used for diagnosing or ruling out white-coat, masked and resistant hypertension. It is also used for monitoring nocturnal, or sleep, BP. Hypertension by ABPM is defined as the 24-hour average ≥ 135 x 85 mmHg[49].

ABPM has been shown to be predictor of cardiovascular endpoints[26,27,29,34,39,42,49-51]. However, the use of 24-hour ABPM is not feasible to screen or chronically manage hypertension – not only is it not widely available, but it is expensive and inconvenient. HBPM, however, is a tool that can and should be used for screening, diagnosis and management of hypertension. HBPM is far more convenient, less expensive, more available and easier for patients to perform than ABPM. It has been shown to correlate well with events and endpoints as previously noted and identify those patients with MH and WCH[41].

OUR CHALLENGE

Our challenge is to improve the less than 30% control rate of this disease. The available evidence suggests that actively involving our patients in managing hypertension may improve control of high BP.

Physician offices should improve protocols for BP measurement using validated devices (Table 2)[2]. They should encourage patients to invest in managing their disease by obtaining a

validated BP monitor which they can use at home (a list of devices can be obtained at: http://www.dableducational.org/sphygmomanometers.html). Patients should check their BP according to the same protocol (Table 2) 2-3 times daily for seven days and average their readings. The frequency of monitoring can vary based on BP control and physician/patient preference. Suspected WCH or MH can be confirmed with 24-hour ambulatory monitoring as available.

Table 2. Measurements of arterial blood pressure

Make sure that the patient's bladder is not full or that the patient has not practiced physical activities, or ingested alcoholic drinks, coffee, food or has smoked up to 30 minutes before the measurement. Keep legs uncrossed and arm heart level[8-13](B) [14](D)
Let the patient rest for 5-10 minutes[8-11,13,15](B)
Use a cuff of appropriate size (rubber bag; width = 40% and length = 80% of arm circumference)[16](B)
Palpate the radial pulse and inflate the cuff until the pulse disappears to estimate the systolic pressure[17](D)
Place the stethoscope's chestpiece over the brachial artery[17](D)
Rapidly inflate the cuff until reaching 20 to 30 mmHg above the estimated level of systolic pressure. Deflate cuff slowly[17](D)
Determine the systolic pressure upon beginning of sounds and diastolic pressure upon disappearance of sounds. Do not round up values to digits ending in zero or five[17](D)

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If health care providers work with their patients and utilize evidence-based resources such as HBP measurement, the potential for real and significant improvement in the hypertension epidemic can be realized. Together, we can achieve appropriate BP goals and improve the live of millions[1,2,22,52-54].

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