ACKD Advances in Chronic Kidney Disease

A Journal of the National Kidney Foundation™

Vol 22, No 2, March 2015

EDITORIAL

Ambulatory Blood Pressure Monitoring: Mercury Rising

In this issue of *Advances of Chronic Kidney Disease*, the 3 coeditors, Debbie Cohen, Jesse Goldman, and John Sim, have marshaled the efforts of 11 sets of authors to provide the readership with updates of the diagnosis and management of the most prevalent cardiovascular disease, hypertension. The 11 articles expansively cover the engaging and multidimensional relationship between hypertension and the kidney. However, this editorial will reflect on some of the vagaries encountered in the day-to-day practice of managing hypertension.

This brief vignette underscores the importance of developing and implementing blood pressure follow-up protocols with involved stakeholders and the utility of home-based blood pressure monitoring. An older man with a 30-year history of high blood pressure had, in his words, "been well controlled" by a 3-drug antihypertensive regimen until recently. However, 7 weeks after an abdominal surgery, his blood pressure, which had only been measured sporadically, was recorded as 198/105 mmHg, and he had a global headache. At 4 weeks postoperatively, his blood pressure had been recorded as normal. Notably, he had been taking only 1 antihypertensive agent then, amlodipine. Losartan and hydrochlorothiazide had been discontinued after surgery because of postoperative normotension. After restarting these, his blood pressure descended into the normal range over the next 4 weeks, while a hypertension specialist followed his case closely and communicated with the patient frequently. Over the next 5 to 6 weeks, the patient engaged in home blood pressure monitoring after the appropriate method of blood pressure measurement was taught to the patient. Three, 5-day blood pressure logs were submitted to the specialist as a surrogate of ambulatory blood pressure monitoring (ABPM). The 5-day blood pressure logs documented 4 blood pressures daily, 2 in the morning and 2 in the evening, following measurements with an oscillometric device that had been calibrated against an in-office aneroid device.[1] Over 4 weeks, the blood pressure logs revealed a decline in the patient's blood pressure to normal level but an absence of the normal decline in blood pressure during the evening and night (Table 1).

Recently, the US Preventive Services Task Force issued the following statement after conducting an exhaustive systematic review, funded by the Agency for Healthcare Research and Quality, regarding the benefits and harms of screening adults for hypertension: "On the basis of the prognostic evidence, we selected ABPM as the reference standard for BP measurement and for evaluating the diagnostic accuracy of other measurement methods.[2] We regarded daytime, night-time, or 24-hour ABPM protocols as acceptable." This statement has broad implications because noninvasive 24-hour ABPM is not routinely carried out in the United States or anywhere else for that matter, although it was conceived of nearly 50 years ago by a team led by Sokolow[3,4] and shown to correlate better than conventional mercury-based sphygmomanometry with blood pressure in the elderly patient.[5] The singular impediment in a fee-for-service environment is simply that the cost of the equipment and time to properly perform ABPM represents a nearly nil return on the investment of several thousand dollars of equipment and computers. There are defined American Medical Association Current Procedural Terminology billing codes for ABPM (93,784 and 93,788), but the only indication is for Medicare beneficiaries with an *International Classification of Diseases, Ninth Revision, Clinical Modification* code 796.2/code R03.0 that signifies an "elevated blood pressure reading without a diagnosis of hypertension," which roughly translates to "suspected 'white coat hypertension (WCH).'"[6] Strictly, WCH is defined operationally: (1) clinic/office blood pressure greater than 140/90 mmHg on at least 3 separate clinic/office visits with 2 separate measurements made at each visit, (2) at least 2 documented separate blood pressure measurements taken outside the clinic/office that are less than 140/90 mmHg, and (3) no evidence of end-organ damage. The trouble with this concept is that it omits individuals with "white coat effect," namely a hypertensive individual who manifests blood pressure elevations in-office for whichever reason.[7] Moreover, if ABPM must be repeated, the qualifying criteria must be repeated. A full 24 hours of blood pressure measurements that encompass

1548-5595/$36.00
http://dx.doi.org/10.1053/j.ackd.2015.01.001

Table 1. A 5-Day, Self-recorded Blood Pressure Log

	AM			PM		
Day	SBP (mmHg)	DBP (mmHg)	HR (bpm)	SBP (mmHg)	DBP (mmHg)	HR (bpm)
1	118	95	82	147	92	76
	135	82	82	149	89	72
2	126	82	82	152	90	71
	131	78	78	119	82	76
3	123	85	85	145	87	78
	131	81	67	134	82	72
4	134	87	84	148	87	65
	116	78	76	118	77	74
5	124	82	75	130	88	83
	122	76	73	121	79	84
Mean BP or HR	126.0	82.6	78.4	136.3	85.3	75.1
Min BP or HR	116.0	76.0	67.0	118.0	77.0	65.0
Max BP or HR	135.0	95.0	85.0	152.0	92.0	84.0
SD BP or HR	6.2	5.2	5.4	12.8	4.7	5.4

Abbreviations: DBP, diastolic blood pressure; HR, heart rate; Max, maximum; Min, minimum; SBP, systolic blood pressure; SD, standard deviation. Seated, right arm blood pressures were obtained during 2 intervals: twice from 0700 to 1000 hours (daytime) and twice from 1900 to 2200 hours (night-time). Means, minima, maxima, and SDs (measure of variability) were computed for SBP and DBP and HR during daytime and night-time intervals.

daytime and night-time blood pressures must be ascertained from the recording device to obtain any reimbursement for conduct of the study.

For non-Medicare patients, few practitioners have bothered to petition third-party payers for reimbursement of ABPM, and fewer of these payers have done so. To rub salt into the wound, the reimbursement is generally disproportionately smaller than what would be anticipated, given the effort entailed to properly read and interpret an ABPM study. The interpretation of ABPM recordings is detailed and must be correlated with the well-kept diary of the putatively hypertensive patient. ABPM interpretation is generally not taught within the curricula of Internal Medicine, Cardiology, Endocrinology, or Nephrology centers simply because there is nothing to teach from. However, ABPM is carried out routinely, and proper interpretation thereof takes place within the rubric of dedicated hypertension fellowships.

If universally applied, ABPM defines and refines the management of 4 groups of patients—Group 1: those who manifested transient hypertension; Group 2: those who incur WCH; Group 3: those who have hypertension; and Group 4: those who have "masked" hypertension (also referred to as isolated ambulatory hypertension: normal office-based blood pressure and elevated blood pressure elsewhere)—undiagnosable in the absence of ABPM. However, some cases of masked hypertension are attributable to nocturnal hypertension (nocturnal systolic blood pressure >120 mmHg).[8] The utility of ABPM in groups 1 and 2 is that individuals will not be inappropriately labeled or treated as having high blood pressure. Ironically, this would be one of the few times that medication nonadherence would be of benefit. Group 3 hypertensives who faithfully reproduce perfect blood pressure records yet truly have high blood pressure will have their hypertension exposed by ABPM. These patients mask their hypertension but do not have the masked hypertension of Group 4, defined as hypertension by ABPM or home blood pressure monitoring with normal office-based blood pressures. This phenomenon occurs in approximately 12% to 14% of those with normal office-based blood pressures and who are not treated as hypertensive patients. Masked hypertension has been correlated with left ventricular hypertrophy, increased carotid artery intima thickness, and decreased large artery distensibility. Cardiovascular disease risk may be equivalent to patients with conventional office-based hypertension. A person with a home blood pressure log that reveals masked hypertension should likely undergo a 24-hour blood pressure recording, to optimize their medical management. Lastly, masked hypertension should be sought out in patients with diabetes and/or CKD and treated accordingly.

ABPM as a monitoring tool is valuable. In the 6-month, 419 participant, treatment-blinded, Belgian Ambulatory Blood Pressure Monitoring and Treatment of Hypertension study, the hypothesis that ABPM vs conventional blood pressure measurement would result in less intensive antihypertensive therapy was fulfilled.[9] Briefly, total medication discontinuation was achieved in 26.3% of those randomized to the ABPM-monitored group vs only 7.3% ($P < .001$) in conventional, office-based group.[9] In the control group, 42.7% progressed to sustained multiple agent therapy vs just 27.2% in the ABPM-monitored group ($P < .001$). ABPM may be of particular utility in elderly patients in whom high pulse pressures correspond to impaired diastolic coronary artery filling and reduced cerebral perfusion. Overly aggressive antihypertensive therapy, which is discoverable by ABPM, can thus be identified and remediated. This risk potential has been at least partially attenuated by the global change of the hypertensive systolic pressure threshold to 150 mmHg for elderly persons by Recommendation 1 of the Eighth Joint National Committee's 2014 Evidence-Based Guideline for the Management of High Blood Pressure in Adults.[10]

ABPM reporting includes facets of the blood pressure that are ignored in routine practice: circadian variation,