**Brief Review**

**Hypertension in Chronic Kidney Disease Part 1**

**Out-of-Office Blood Pressure Monitoring: Methods, Thresholds, and Patterns**

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Hypertension is highly prevalent in chronic kidney disease (CKD), particularly in patients with end-stage renal disease (ESRD) receiving hemodialysis.1,2 The identification and treatment of hypertension in CKD has to face peculiar problems because of the marked alterations in 24-hour blood pressure (BP) profile, in particular of a reduced BP dipping at night, and the high prevalence of specific hypertension phenotypes, such as white coat (WCH) and masked hypertension (MH). Moreover, the ebb and flow of fluid volume in hemodialysis patients makes a proper assessment and achievement of BP control even more difficult. Although conventional BP measurements (CBP), performed in the office or in the dialysis unit by healthcare personnel, are currently recommended and applied for the diagnosis and management of hypertension in patients with CKD, including those on dialysis, these metrics are intrinsically inaccurate.3,4 CBP measurements are known to fail providing reliable estimates of the actual BP burden in several clinical conditions, and this is even more so in CKD and in hemodialysis patients. Thus, in addition to CBP measurements, proper assessment and management of hypertension in these patients should be ideally based also on out-of-office BP measurements, including ambulatory BP monitoring (ABPM) and home BP monitoring (HBPM), as acknowledged by a consensus document by the American Society of Hypertension and the American Society of Nephrology.5 In this article, we highlight the advantages and disadvantages of out-of-office BP monitoring for the management of arterial hypertension in these conditions, based on a thorough literature search through classical engines, such as Pubmed and Web of Science, supplemented by the authors’ own expertise.

**BP Thresholds for the Diagnosis and Treatment of Hypertension in CKD and in ESRD Patients**

The thresholds to define hypertension and BP targets for antihypertensive treatment in CKD patients are debated.6,7 The recommendation to lower office BP to <130/80 mm Hg in CKD provided by former guidelines for management of arterial hypertension8–10 has been challenged by randomized controlled trials showing that the risk of death and progression to ESRD is not significantly reduced in patients who achieve an office systolic BP (SBP) of 125 to 130 mm Hg.11–13 Besides, meta-analyses of trials exploring different BP targets in subjects with CKD did not show consistent cardiovascular and renal benefits in patients randomized to an

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office BP target lower than the conventional one (<140/90 mmHg). In contrast, preliminary data of a large intervention trial including CKD patients—the systolic BP intervention trial (SPRINT)—have recently suggested a substantial benefit of lowering SBP below 120 mmHg. In the predefined subgroup of patients with CKD, the benefit from intensive BP lowering in terms of the primary study outcome did not reach statistical significance, whereas there was a significant benefit in overall mortality, superimposable with what observed in subjects without CKD. The recent 2013 European Society of Hypertension/European Society of Cardiology guidelines issued more prudent recommendations, indicating an office BP <140/90 mmHg as a treatment target also in CKD patients. However, the same guidelines suggest lowering office SBP to <130 mmHg when overt proteinuria is present, provided that changes in estimated glomerular filtration rate are monitored. Similar recommendations were made by the Eighth Joint National Committee (JNC-8). The Kidney Disease: Improving Global Outcomes (KDIGO) Guidelines recommendations indicate a target of <130/80 mmHg in CKD patients with albuminuria. Although the African American Study of Kidney Disease (AASK), the Ramipril in Non-Diabetic Renal Failure (REIN), and Modification of Diet in Renal Disease (MDRD) trials do not generally support target values of ≤130/80 mmHg for CKD, subgroup analyses show a benefit of tighter BP control in CKD patients with albuminuria. Also recent long-term analyses of the MDRD trial have supported a legacy effect of lower BP targets.

A U-shaped or an inverse relationship between BP levels and risk of mortality was noted in hemodialysis patients almost 2 decades ago and confirmed in several studies. Notably, pre- and postdialysis SBP levels between 120 and 180 mmHg were practically not associated with different cardiovascular risk, in contrast with the associations found in the general population or in other high-risk groups. Furthermore, a decline rather than an increase in predialysis SBP over time associates with adverse cardiovascular outcomes. However, observational studies like those discussed earlier are inherently inadequate to solve the problem of defining BP thresholds and BP targets in the hemodialysis population. As it will be discussed later, predialysis BP mainly reflects a volume-expanded state, and therefore, the relationship of predialysis BP parameters with death or cardiovascular events may not coincide with the relationship between the actual daily life BP burden characterizing these patients and the same outcomes. Recent analyses in patients from the Chronic Renal Insufficiency Cohort (CRIC) who progressed to kidney failure and started hemodialysis again confirmed a U-shaped relationship between predialysis BP and the risk of death but also showed that in the same patients’ office SBP measured outside the dialysis unit during a standard visit was almost linearly related with the risk of death, as in the general population. In sharp contrast with observational data showing a nonlinear association between BP and clinical outcomes, a meta-analysis of clinical trials testing antihypertensive medications applied to treat hypertension, left ventricular systolic dysfunction, or heart failure in hemodialysis patients showed better outcomes with lower achieved BP values.

Are CBP Measurements Adequate for the Assessment and Management of Hypertension in CKD?

The prevalence of hypertension gradually increases as renal function deteriorates, and a high BP condition is almost universal in patients who progress to ESRD. Population studies with CBP measurements have shown hypertension prevalence around 70% to 80% in patients with stage 1 CKD, whereas in stages 4 and 5 before initiation of dialysis, this rate increases to >95%. CBP measurements are less than ideal to guide hypertension treatment in CKD. They are misleading in a large proportion of patients because as much as 40% of those who are apparently normotensive by CBP turn out to be hypertensive by HBP. On the other hand, an analysis by investigators of the Spanish ABPM Registry including over 5000 hypertensive patients with CKD stage G1-5 showed that hypertension as assessed by office BP measurements (2140/90 mmHg: 78%) was much more frequent than when assessed by 24-hour ABPM (≥130/80 mmHg: 56.5%). They also found a high prevalence of WCH and a significant prevalence of MH (estimated around 30% and 7%, respectively), supporting a wider use of ABPM to diagnose and reliably evaluate the efficacy of hypertension treatment in this population.

Assessment of BP control in ESRD patients is even more complex. The increase in intravascular volume during the interval between dialysis sessions, fluid removal during dialysis, left ventricular dysfunction, arterial rigidity, erythropoiesis-stimulating agents, abolished renal excretion, modified intestinal uptake, and dialysis clearance of antihypertensive drugs all contribute to the marked BP variability and inconsistent BP control in these high-risk patients. The application of ABPM in hemodialysis patients, however, faces particular problems, including the frequent technical inability to perform BP monitoring because of multiple arterio-venous fistula or arterial graft interventions and limited tolerance of the ABPM apparatus by dialysis patients who already have serious sleeping problems because of pain and itching. Hemodialysis patients who initially accept ABPM, after the first experience, often refuse repeating a 24-hour BP recording. In a recent survey by the European Renal Association–European Dialysis Transplantation Association (ERA-EDTA), less than half of dialysis centers declared to apply ABPM. Thus, the large-scale applicability of ABPM in hemodialysis patients clearly deserves further investigation.

Hypertension remains a major problem even after renal transplantation, and at least 50% of these patients are frankly hypertensive. Calcineurin inhibitors like cyclosporine and tacrolimus induce hypertension and contribute to a paradoxical nocturnal BP rise in the transplant population. In contrast to early CKD, hypertension in transplanted patients tends to be more severe when evaluated by ABPM than by CBP and is frequently associated with nocturnal hypertension and BP nondipping (the latter issue will be further developed in a twin manuscript separately published). Only 16% of kidney recipients off antihypertensive drugs are truly normotensive (normal CBP and ABP levels), and e=44% of those receiving antihypertensive treatment fail to achieve BP control when assessed by ABPM (ie, they are characterized by masked uncontrolled hypertension). These findings, along with the
frequent occurrence of MH, further point to the relevance of implementing ABPM also in the transplant population.

**ABPM in CKD and ESRD: ABPM Thresholds**

As repeatedly emphasized, CBP measurements cannot track the BP changes occurring in daily life, and pre- and post-dialysis BP correlate poorly with 24-hour ABP in ESRD patients.34,35 Thus, adequate diagnosis and management of hypertension in these patients should include out-of-office BP measurements. Noninvasive ABPM techniques, based on automated oscillometric, arm-cuff BP readings, are widely available and allow collection of a large number of BP readings over the 24 hours during the daily life behaviors characterizing daytime and nighttime subperiod conditions.35 The technical aspects to consider when performing ABPM in clinical practice (ie, device selection and validation, measurement intervals, editing and interpretation of BP recordings) and the description of the advantages and disadvantages of this technique for guiding and assessing antihypertensive treatment and for predicting cardiovascular prognosis have been addressed in a recent position paper of the European Society of Hypertension.35,36 However, although there is consistent evidence to define normalcy levels for ABP values in non-CKD populations (ie, <135/85 mm Hg for daytime, <120/70 mm Hg for nighttime, and <130/80 mm Hg for 24 hours),35 no solid, specific information exists for CKD patients, and thus, no specific ABPM targets are given in current guidelines on ABPM for this population.35,36 In line with the prudent attitude adopted by the European Society of Hypertension guidelines for office BP targets,6 the ABPM targets suggested by the position paper of the same society35 can be provisionally recommended also for CKD patients before starting hemodialysis (Table). According to a document of the American Society of Hypertension and the American Society of Nephrology,7 in ESRD patients on dialysis, the diagnosis of hypertension is made when 44-hour ABP over the dialysis interval is ≥135/85 mm Hg. Although awaiting for specific studies adopting ABPM to titrate antihypertensive treatment with the aim of reducing ABP below these levels, given the high cardiovascular risk of this population, BP goals in hemodialysis patients should be established individually, taking into account age, comorbid conditions, cardiac function, and neurological status. Clinical trials based on ABPM measurements and well-designed ABPM registries thus remain a priority if we are to apply evidence-based treatment of hypertension in CKD and in ESRD patients.

**HBPM in CKD and ESRD**

Because of the wide availability of accurate automated BP measuring devices, their relatively low cost, and their easy acceptability by both patients and physicians, recent guidelines have recommended routine clinical use of HBPM.37,38 For diagnostic evaluation, guidelines suggest collecting HBPM measurements daily on at least 3 to 4 days and preferably over 7 consecutive days in the morning as well as in the evening. Measures should be performed in a quiet room, with the patient in seated position, back and arm supported, after 5 minutes of rest, and with two measurements per occasion taken 1 to 2 minutes apart.37,38 By enhancing patients’ involvement and compliance with treatment, this technique has the potential to increase the rates of BP control. BP measurements obtained by patients at home over several days, weeks, or months provide a representative measure of patient’s daytime BP load, also allowing assessment of BP changes in the long term. Compared with CBP, HBPM measurements are more strongly associated with target organ damage, progression of CKD, functional decline in the elderly, cardiovascular events, and all-cause mortality.38–45 To which extent the standardization of HBPM measurements, which is still a problem in routine practice, may influence these relationships is still unknown, however.46 Although HBPM targets to be attained with antihypertensive treatment in essential hypertensive patients without CKD are still to be defined, the European Society of Hypertension position paper on HBPM suggested to use a

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**Table. Definition of Hypertension and Indications for Drug Therapy of Hypertension in CKD and in ESRD Patients**

<table>
<thead>
<tr>
<th>Definition</th>
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<tbody>
<tr>
<td>Hypertension in CKD and in dialysis patients should be defined on the basis of home (HBPM) or 24-h ambulatory BP monitoring (ABPM) during a mid-week dialysis interval. Thresholds proposed by the ESH and the ESC can be adopted for CKD patients,6 and those by the ASH and the ASN,7 for hemodialysis patients, as below</td>
</tr>
<tr>
<td><strong>Home BP measurements:</strong> ≥135/85 mm Hg both for CKD patients and for hemodialysis patients.</td>
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<tr>
<td>Twenty-four-hour ambulatory BP ≥130/80 mm Hg for CKD patients and ≥135/85 mm Hg for hemodialysis patients. In hemodialysis patients, ABPM should be performed during a mid-week dialysis interval and, whenever feasible, extended to 44 h.</td>
</tr>
<tr>
<td>For hemodialysis patients, no recommendation can be made on the basis of predialysis or postdialysis BP. When neither ABPM nor home BP measurements are applicable in dialysis patients, the diagnosis and the management of hypertension can be made on the basis of conventional BP (CBP) measurements taken during the dialysis interval. At variance with predialysis BP which has an U-shaped relationship with risk of death, in the same patients, the average of 3 office measurements (obtained in the sitting position after at least 5 min of quiet rest by trained personnel) is almost linearly related to the risk of the same outcome.71 The threshold of office BP (≥140/90 mm Hg) recommended by current guidelines for the definition of hypertension in CKD patients6 can be extended also to hemodialysis patients.</td>
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<tr>
<td><strong>Drug therapy goals</strong></td>
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<tr>
<td>Particularly for hemodialysis patients, arterial pressure goals should be established individually, taking into account age, comorbid conditions, cardiac function, and neurological status.</td>
</tr>
</tbody>
</table>

ASH indicates American Society of Hypertension; ASN, American Society of Nephrology; BP, blood pressure; CKD, chronic kidney disease; ESC, European Society of Cardiology; ESH, European Society of Hypertension; ESRD, end-stage renal disease.
threshold value $\geq 135/85$ mm Hg (corresponding to an office BP $\geq 140/90$ mm Hg) for diagnosing hypertension\(^{38}\) (Table), based on several observational studies and meta-analyses.\(^{47-52}\) In the absence of specific studies for CKD patients, the same threshold has been suggested also for this population. For hemodialysis patients, 2 daily HBP measurements, one in the morning and the other before the night sleep, taken the day after a midweek dialysis session and averaged over 4 weeks are considered adequate for the diagnosis of hypertension.\(^{53}\) While waiting for ad hoc studies, the same hypertension threshold as adopted in the general population and provisionally suggested for CKD patients ($\geq 135/85$ mm Hg; Table) is also proposed to be applied in hemodialysis patients. The frequency of measurements should be higher when excessive BP lability is noted. In the sole cohort study published to date in this condition, all-cause and cardiovascular mortality were lowest in patients with home SBP ranging from 120 to 145 mm Hg.\(^{44}\)

Masked and White Coat Hypertension in CKD

The combination of office and out-of-office BP allows identification of specific hypertension phenotypes in untreated patients,\(^{54}\) that is, sustained hypertension (elevated CBP and ABP/HBP), sustained normotension (normal CBP and ABP/HBP), WCH (elevated CBP and normal ABP/HBP), and MH (normal CBP and elevated ABP/HBP). When considering treated patients, the occurrence of normal CBP with elevated ABP/HBP is defined masked uncontrolled hypertension (MUCH), whereas the finding of elevated CBP with normal ABP/HBP is defined as white coat–resistant hypertension. This categorization (Figure 1) provides useful information for the assessment of hypertension and its response to treatment. In a cross-sectional analysis of the Spanish ABPM Registry examining the concordance/discordance between office BP–based and ABP based control in treated hypertensive patients with CKD, MUCH, and white coat–resistant hypertension had a 7.0% and 28.8% prevalence, respectively.\(^{55}\) In a report of the AASK, \(\approx 70\%\) of subjects with controlled CBP ($<140/90$ mm Hg) were shown to have elevated systolic/diastolic ABP levels (MUCH, ie, $\geq 135/85$ mm Hg during daytime or $\geq 120/70$ mm Hg during nighttime),\(^{55}\) and cardiac and renal organ damage was significantly higher in patients with elevated nighttime BP, MH (or MUCH, if treated), or sustained hypertension as compared with those with truly controlled BP or WCH (white coat–resistant hypertension if treated).\(^{55}\) The high prevalence and adverse cardiovascular prognosis associated with MH and MUCH emphasize the importance of detecting these phenotypes in CKD patients to better prevent cardiovascular and renal complications associated with these conditions. Current guidelines recommend implementation of ABPM/HBPM in most treated hypertensives, even if they have controlled BP based on CBP measurements, in particular in patients likely to have MUCH (ie, $>60$ years with high-normal systolic CBP, smokers, or male patients $>70$ years), as well as in patients with high-normal CBP at a high cardiovascular risk or with established cardiovascular disease.\(^{37}\)

![Figure 1. Classification of patients based on the comparison of conventional office blood pressure (CBP) and home (HBP) or ambulatory blood pressure (ABP) levels separately in untreated individuals (left) and in treated hypertensive patients (right). Reference threshold values for ambulatory BP levels during daytime (ie, 135/85 mm Hg), 24 hours (ie, 130/80 mm Hg), and nighttime (ie, 120/70 mm Hg) and for average HOME BP levels (ie, 135/85 mm Hg) are provided according to recent guidelines.\(^{35,36}\) Modified from Parati et al\(^{37}\) with permission of the publisher. Copyright © 2008, Wolters Kluwer Health, Inc.](http://hyper.ahajournals.org/)

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hand, identification of WCH, which may be present in ≈50% of patients with CKD\textsuperscript{56} may avoid unnecessary BP-lowering treatment, which in particular conditions, such as the elderly or in presence of severe atherosclerotic disease, may compromise renal and cardiac perfusion leading to episodes of acute kidney injury or coronary ischemia.\textsuperscript{53,57,58} Recent studies investigating the potential long-term implications of WCH, however, have indicated that subjects with this BP pattern have a higher risk for developing sustained hypertension, metabolic abnormalities, cardiovascular organ damage, and cardiovascular events and mortality than those with sustained normotension, although this risk is lower than in individuals with MH and sustained hypertension. It has therefore been suggested that patients with WCH could benefit from active follow-up and lifestyle counseling and even from drug treatment in specific high-risk cases.\textsuperscript{59–64}

A recent report of a large study in CKD has provided estimates on the prevalence and reproducibility of MUCH in this specific population. Overall, the prevalence of MUCH was 26.7% by daytime ABP, 32.8% by 24-hour ABP, 56.1% by daytime or nighttime ABP, and 50.8% by HBP. Reproducibility of the diagnosis of MUCH was assessed by repeating these measurements after 4 weeks. Agreement in MUCH diagnosis by repeated ABP was 75% to 78% (k coefficient for agreement, 0.44–0.51), depending on the definition used. In contrast, HBP showed an agreement of only 63% and a k coefficient of 0.25. Because reproducibility of HBP was not different from that of CBP in diagnosing MUCH, the study concluded that confirmation of MUCH diagnosis should rely on ABPM.\textsuperscript{65}

Evidence that ABPM may have a value in ESRD patients to detect WCH and MH has also been provided by recent studies in hemodialysis patients in whom the prognostic value of BP obtained in the dialysis unit was refined with ambulatory BP levels.\textsuperscript{24}

**Improving BP Control With ABPM and HBPM in CKD and in ESRD**

BP control rates in CKD are unsatisfactorily low. Only 27% of treated hypertensives with CKD have CBP <140/90 mm Hg and only 11% reach a CBP target <130/85 mm Hg.\textsuperscript{1,66} Population studies with CBP measurements suggest that hypertension control rates are low in individuals with CKD; only 20% to 38% of individuals achieve CBP <140/90 mm Hg, whereas this rate falls to 6% to 18% when the threshold <130/80 mm Hg is used.\textsuperscript{25} Notably, control rates slightly increase with advancing stages of CKD because of increased awareness and treatment of hypertension.\textsuperscript{25} In CKD patients, the prevalence of systolic and diastolic hypertension (defined as daytime ambulatory SBP ≥130 mm Hg and DBP ≥80 mm Hg) is 62% and 30%, respectively,\textsuperscript{66} indicating that in these patients, attention should focus more on SBP control. In a meta-analysis of studies comparing ABP and pre- and postdialysis BP measurements in hemodialysis patients, predialysis BP overestimated ABP levels during the 48-hour interdialysis period, whereas postdialysis values underestimated ABP levels, and the agreement between ABP and pre- and postdialysis BP was poor.\textsuperscript{5} On this basis, an expert’s consensus proposed performance of ABPM during the interdialytic period as the standard approach for the assessment of BP levels in ESRD.\textsuperscript{67} and this recommendation was reiterated by the joint statement of the American Society of Hypertension and the American Society of Nephrology. Because hypertension in hemodialysis patients largely reflects volume overload and BP normalization may be an index of extracellular euvolemia, ABPM might represent also a tool to assess BP-lowering strategies aimed at normalizing sodium and fluid balance in ESRD (ie, dry weight probing).\textsuperscript{68} However, only few studies have explored the benefits of implementing ABPM for guiding antihypertensive treatment in hemodialysis. As previously discussed, although there are no doubts on the theoretical superiority of ABPM over other BP measuring techniques, the large-scale applicability of ABPM is an open issue, and because of particular patient-related barriers and of reimbursement issues, the majority of dialysis centers still do not apply ABPM in hemodialysis patients.\textsuperscript{29}

With regards to HBPM, current guidelines for management of arterial hypertension recommend its use as part of the routine diagnostic and therapeutic approach to hypertension\textsuperscript{69} and give precise indications for BP measurement at home.\textsuperscript{37} As alluded to before, the use of HBPM for the diagnosis of hypertension and the achievement of BP goals in CKD is supported by the fact that it reduces the misclassification resulting from the white coat effect,\textsuperscript{66} but there is still no solid study on the value of using this technique toward achieving BP goals.

In patients with ESRD, a proper implementation of HBPM allows sampling BP levels at different time points throughout the interdialytic period, thus providing a better assessment of BP control. In line with observations in patients with essential hypertension, in an open trial comparing the effectiveness of antihypertensive treatment in 2 groups, one applying HBPM and the other using predialysis CBP measurements, in the HBP-based management group, a 12 mm Hg decrease in 24-hour systolic ABP was observed, whereas 24-hour ABP levels remained unmodified in the group managed based on predialysis CBP.\textsuperscript{69} Another advantage of HBP is that it reflects ABP changes brought about by ultrafiltration intensification to improve hypertension control in hemodialysis patients.\textsuperscript{53} Telemonitoring of HB values increases compliance to treatment and BP control in treated essential hypertensives\textsuperscript{70,71} and might prove useful also in ESRD patients, but limited evidence is available in this regard.

**Superior Prognostic Value of Average ABP and HBP Values in CKD and in ESRD Patients**

There is solid evidence supporting the superior prognostic value of ABP (either over 24 hours or daytime or nighttime) and of HBP levels over CBP values. However, although most of this evidence comes from studies conducted in the general population or hypertensive subjects, there are few hard outcome trials comparing HBP, ABP, and CBP levels in CKD populations.

In CKD patients, the superior prognostic power of ABP over CBP was demonstrated in a cohort of 436 consecutive patients with CKD by Minutolo et al.\textsuperscript{56} In this study, ABP levels (particularly nighttime SBP) nicely predicted the primary end points of renal death and fatal and nonfatal CV events after 4.2 years of follow-up, whereas CBP largely failed to
predict the same outcomes (Figure 2). The superior prognostic value of ABP over CBP in CKD was also shown in several other studies.33,72,73 In a study by Gabbai et al, in treated hypertensives with CKD with apparently adequate SBP control (ie, systolic CBP <130 mm Hg), the risk of death, cardiovascular disease, and progression to kidney failure was higher in the subgroup with relatively higher average 24-hour, daytime, and nighttime systolic ABP levels.72

In a study by Agarwal et al in hemodialysis patients,43 ABP showed a better association with left ventricular hypertrophy (LVH) than CBP, whereas ABP and CBP had a similar degree of association with LVH in another study in the same population.73 On the contrary, evidence has been produced that ABP outperforms CBP as a predictor of cardiovascular events42,74 and all-cause mortality75,76 in ESRD. ABPM during the interdialytic period is a direct predictor of mortality and is clearly superior to pre- and postdialysis measurements for prognostic evaluation in these patients.72 In another cohort study in the same population, ABP measures performed during the interdialytic period predicted mortality, whereas neither pre- nor postdialysis BP was associated with the same outcome.45 As to HBPM, the superior value of this technique over CBP in predicting progression of renal dysfunction39,40 and development of cardiovascular events and mortality41,42 is well supported. In a cohort of veterans with CKD, home SBP emerged as an independent and better predictor of ESRD and mortality as compared with CBP.41 Also in patients with ESRD, HBP values seem superior to pre- or postdialysis CBP readings. Indeed HBP measurements were associated with LVH more strongly than pre- and postdialysis CBP, and the strength of the HBP-LVH association was of the same order as the one between ABP and the same outcome measure.43 Finally, 2 cohort studies comparing pre- and postdialysis BP versus HBP measurements during the interdialytic period documented the superiority of HBP in predicting all-cause and cardiovascular mortality in the hemodialysis population44,45 (Figure 3).

Conclusions
CBP measurements performed in the office or in the hemodialysis unit fail to provide a representative estimation of the actual BP load in renal patients. A proper identification and management of elevated BP levels in CKD as well as in ESRD patients should thus include out-of-office BP measurements in addition to CBP. This might reduce misclassification of hypertension by identifying WCH and MH or MUCH, may allow initiation of treatment in MH and prevent unnecessary therapy for WCH. Such information might be useful to the practicing physician to optimize antihypertensive treatment and to achieve stable BP control in the long term. Reliance on CBP alone for the diagnostic and therapeutic approach to
hypertension in CKD needs thus to be reconsidered. Current international guidelines strongly support the use of ABPM and HBPM in clinical practice as a fundamental complement to conventional office or pre- and postdialytic BP measurements. Data from ABPM registries in CKD will help to clarify still pending important issues, such as defining the ABP targets that maximize CV protection in CKD and to what extent guiding BP-lowering strategies and assessing BP control with ABPM/HBPM might help to reduce CV morbidity and mortality in CKD. Finally, to more consistently support the clinical usefulness of ABPM and HBPM in CKD patients, we would need randomized intervention outcome trials comparing these BP measuring methods with CBP by using treatment algorithms designed to aim at appropriately defined targets for each specific randomization group and focusing on their impact on clinical outcomes. Special studies are also needed to assess the applicability of ABPM on a large scale in hemodialysis patients.

Disclosures

None.

References


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