Assessing Blood Pressure Control in Dialysis Patients
Finally a Step Forward

Keith Hopkins, George L. Bakris

Cardiovascular (CV) disease is the leading cause of death among hemodialysis patients.1 Poorly controlled blood pressure (BP), a major risk factor for CV events, also remains 1 of the 2 most common causes of chronic kidney disease and contributes to development of end-stage renal disease (ESRD).1

More than a decade ago, a positive correlation was noted between systolic BP and development of cardiac structural abnormalities in hemodialysis patients who lacked other comorbid conditions.2 More recently, volume overload is now appreciated as a relatively greater contributor to increases in ventricular hypertrophy relative to the presence of stage 1 hypertension in ESRD patients.3

The range of postdialytic BP is also important as a factor in contributing to CV events in ESRD patients. Zager et al4 noted a “U-shaped” relationship between postdialysis systolic pressure and mortality risk. Although higher mortality rates were observed in those with postdialytic systolic pressures >140 mm Hg, an increase was also noted in those with posttreatment systolic pressures <110 mm Hg. Interestingly, in the latter study, an elevated predialysis BP was not associated with higher CV risk.

Despite the wealth of available data, associating the level of BP with worsening chronic kidney disease and CV events in the general population, no consensus exists as to the diagnosis and subsequent treatment of hypertension to affect CV risk reduction in ESRD patients. There is a paucity of data in ESRD patients regarding what BP level should be achieved to reduce CV events and peridialytic adverse effects. This is further exemplified by recent National Kidney Foundation/Kidney Disease Outcomes Quality Initiative guidelines that fail to provide a goal BP for dialysis patients but suggest that there be “every incentive to control BP as early as possible before cardiac damage leads to permanent hypotension and an almost certain early death.”

There has been a prolonged debate over whether single or 2-week averaged conventional dialysis center BP values are more accurate than single or 2-week averaged home monitor readings in predicting clinical outcomes in ESRD patients. A recent review to assess when BP should be measured in ESRD patients notes that peridialysis BP measurements are adequate for evaluating dialysis-related hemodynamic stability, but home BP readings are superior to diagnose hypertension.6

BP variability is present in all people but is particularly prevalent in ESRD patients. This greater variability is related to the following: (1) the location where BP is measured (in-center or home); (2) time in relation to renal replacement therapy (predialytic or postor interdialytic); and (3) method of BP measurement (intravascular, oscilometric, or auscultatory). To evaluate pressure fluctuations better over the 24-hour period, ambulatory BP (ABP) is the “gold standard.” ABPs can provide information during sleep and early morning awakening, when BP and CV risks are highest.5,7 Artifactual pressures because of the sheer volume of measurements (every 30 minutes during the day and hourly at night) are also minimized. ABPs are far more sensitive than routine cuff measurements in dialysis patients for correlating CV risk factors such as left ventricular hypertrophy.8

Taken together, these observations indicate that guidance is needed to properly assess BP in ESRD patients and that excess volume is key to the etiology associated with elevated BP and ventricular structure abnormalities in the ESRD patient.9 In this issue of Hypertension, Agarwal et al9 analyzed a new method focused on improving BP management using dry-weight reduction and evaluated the time course of any elicited response. They used a method of hypertension control through a systematic and gradual increase in volume removal by hemodialysis with a close monitoring of dialysis-related adverse effects. A group of 100 patients underwent additional ultrafiltration using a standardized methodology within their standard hemodialysis time period. A separate group of 50 patients did not have any reduction in their standard dry weight, although they too had their dry weights and dialysis-related BPs closely monitored. The primary outcome was change in interdialytic systolic ABP, limited by signs and symptoms of hypovolemia with the calculated proportion of treatments complicated by end points such as cramps and dizziness.

In the experimental group, a postdialytic decrease in weight of 0.9 kg resulted in a systolic and diastolic BP reduction of 6.9/3.1 mm Hg. At 8 weeks, a similar reduction in BP occurred with a 1-kg reduction in dry weight. ABPs were performed over 44 hours weekly, using calculated hourly means averaged over the entire period to arrive at the given representative pressures. Interdialytic weight gain affected both ambulatory and predialysis BP values. There was minimal difference in study weight gains between groups with values of 2.9 versus 2.8 kg over the analysis period. It is noteworthy that, whereas all of the study subjects continued...
to receive their antihypertensive medications, more than half of the experimental group had additional reductions in systolic BP of >10 mm Hg compared with baseline.

An additional finding in this study was the observation that pulse pressure was reduced in responders. This is important, because many data analyses suggest that a widened pulse pressure is associated with increased CV mortality in hemodialysis patients.\textsuperscript{10,11} Other factors that need action in future studies include racial differences in BP response, sustainability of BP effect, and proven morbidity/mortality reduction.

In short, this study is the first to define a methodology that effectively assesses BP in ESRD patients and provides a means for reducing BP in such patients. Clearly, the use of home BP and 44-hour ABPs is a start. A longer evaluation period would determine any “lag-time” effects on antihypertensive therapy and patient quality of life. No previous work has collected this amount of information on diagnosis and management of hypertension in a dialysis cohort. As such, the Dry-Weight Reduction in Hypertensive Hemodialysis Patients study leads the way to further prospective studies that will provide meaningful and more facilitated ways to assess BP in the ESRD population.

**Disclosures**

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**References**

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