

Editorial

Is cloud-based technology a promising tool in the integrated care of patients with chronic kidney disease?



Chronic kidney disease (CKD) is one of the most prevalent noncommunicable diseases in Taiwan.¹ Previous studies have provided solid evidence of an association between CKD and the increased risk of death, cardiovascular event and end-stage renal disease.² In recent years, albuminuria has also been recognized as another major risk factor for cardiovascular disease and CKD progression.² Together, CKD and albuminuria are multiplicatively associated with an increased risk of mortality.³

Currently, the principle approach to lowering the risk of kidney failure and major cardiovascular event in CKD patients with overt proteinuria is intensive blood pressure (BP) control.^{4,5} The 2012 Kidney Disease Improving Global Outcomes (KDIGO) clinical practice guideline suggests an appropriate BP control target level is consistently $\leq 130/80$ mmHg in CKD patients with urine albumin excretion > 300 mg/day,⁶ although different targets may be recommended by others.⁷

Despite the importance of BP control, in one cohort study, only 26% of CKD patients achieved the BP goal suggested by Joint National Committee 7 guidelines.⁸ An extensive Cochrane review concluded that home BP monitoring, coupled with an appointment reminder system may help patients improve blood pressure control.⁹ However, the results require further evaluation and most of the trials excluded patients with moderate-to-severe kidney disease.

In this issue of the *Journal of the Chinese Medical Association*, Lin et al¹⁰ report a randomized trial comparing two models of home BP monitoring in hypertensive CKD patients. Forty-eight hypertensive patients were included, each with an estimated glomerular filtration rate < 60 mL/minute/1.73m². Twenty-five patients were randomly assigned to the intervention group, where cloud-based manometers integrated with a physician order entry system were applied. Physicians at least weekly reviewed the BP records of patients in the study, and the patients were recalled to the clinic as needed. The other group of patients in the study used the regular home BP recording sheets and had medical adjustment during routine outpatient visit. During the 6-month study period, BP, serum creatinine (Cr), and the spot urine proteinuria–Cr ratio (UTP/UCr) were assessed at baseline and every 3 months. Several patients were lost in follow-up after the enrollment, such that the final analysis included 18 patients from both groups.

The baseline characteristics between the two groups were comparable in sex, age, CKD stages, body mass index, estimated glomerular filtration rate, Cr, hematocrit, albumin, cholesterol, UTP/UCr, morning BP, and nighttime BP. At 6 months, the nighttime systolic BP (128.1 ± 13.5 mmHg vs. 138.7 ± 9.2 mmHg) and diastolic BP (72.1 ± 5.5 mmHg vs. 75.9 ± 8.5 mmHg) were significantly lower in the intervention group despite no difference in the morning BP. Besides, when compared with the baseline values, the nighttime systolic and diastolic BP were also significantly lowered in the intervention group.

A recent randomized trial of 450 uncontrolled hypertensive patients also showed a similar result, where 84 (18.6%) of them were CKD.¹¹ In that study, patients who received home BP telemonitoring with pharmacist management realized more substantial improvements in BP control and decreases in BP than patients who received the usual care. During a 12-month study period, greater antihypertensive medication intensification was noted, as well as better self-reported adherence to antihypertensive medication and sodium restrictions.

Among uncontrolled hypertensive patients, medical non-compliance is one of several important factors.¹² The beneficial effect of home BP monitoring may be due to the improvements in medical compliance and families' participation since they realized that BP levels were constantly monitored by physicians. By contrast, although the frequency of patients' recall was not provided, a more timely assessment and medical adjustment may also improve the outcome. However, although nighttime BP was improved by the intervention, the optimal goal of home BP control is still unknown.

The guidelines for BP management are derived from the results of randomized control trials targeting BP in an office environment. Discrepancies were noted between the office and 24-hour BP values in hypertensive populations.¹³ Measuring the home BP is superior to office BP in reducing the misclassification of hypertension in patients with CKD.¹⁴ Some evidence has also demonstrated that home BP is a significant predictor of renal failure and death in CKD patients.¹⁵ Therefore, home BP monitoring may not only provide better BP control, but also be useful for risk stratification in CKD patients. However, whether it will translate into a better clinical outcome is yet to be determined.

In this study,¹⁰ the serum Cr level was significantly lower in the intervention group at the end of study (2.83 ± 2.0 mg/dl vs. 4.38 ± 3.0 mg/dl). The possible explanations for this may include differences in the underlying patient diseases, the classes of medications used by patients for BP control, or the achieved BP values between the two groups. Although the levels of the UTP/UCr between the two groups were insignificant, a lowering trend was noted in the intervention group. The authors suggested that the improvements of UTP/UCr from baseline may be associated with the lower achieved night time BP. However, further correlation analysis was needed to clarify this assumption.

This pilot study demonstrated a significant decrease in nighttime BP in CKD patients by using cloud-base BP manometers integrated with physician order systems. Compared to the control group, serum Cr level was also lowered significantly by this approach. However, some limitations should be considered in interpreting the results. The sample size was relatively small and thus the power of the analysis may be compromised. The study was not blinded, and potential bias may exist in the way physicians managed the BP values. Several important baseline characteristics were not presented, including the number of hypertensive drugs classes and the nature of the underlying diseases. Further randomized controlled trials with larger sample size and solid end-points are needed. Additionally, such further studies could also examine the cost-effectiveness and the patients' acceptance of this approach.

Conflicts of interest

The authors declare that there are no conflicts of interest related to the subject matter or materials discussed in this article.

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