Further Insight on the Phosphate Balance in Chinese Peritoneal Dialysis Patients

Hyperphosphatemia is an exceedingly common complication in patients with end-stage renal disease (ESRD). Recent retrospective analysis of data from the US Renal Data System Case-Mix Adequacy Study and the Dialysis Morbidity and Mortality Wave II Study showed that of the total 6,407 prevalent long-term hemodialysis patients, 70% had serum phosphorus levels greater than 1.6 mmol/L. Nearly half of these patients had serum phosphorus levels greater than 1.9 mmol/L, and 39% had serum phosphorus levels greater than 2.1 mmol/L, indicating a high prevalence of hyperphosphatemia in the ESRD population [1]. Moreover, these studies showed an important association between serum phosphorus level and mortality in hemodialysis patients: for every 0.3 mmol/L increase in serum phosphorus levels, there was a 6% increase in mortality risk [1]. Patients with serum phosphorus levels of 2.1–2.5 mmol/L had an 18% greater mortality risk, whereas those with levels of 2.6–5.5 mmol/L had a 39% greater mortality risk than those with levels of 1.5–1.8 mmol/L. Adjusting for other potential confounders (including comorbid conditions, nutritional status, and delivered dose of dialysis) did not lower the mortality risk for patients with serum phosphorus levels greater than 2.1 mmol/L [1].

The prevalence of hyperphosphatemia is highly variable across different countries. Although the traditional Chinese diet is rich in vegetables and has a low protein content, hyperphosphatemia is a frequent complication in Chinese peritoneal dialysis (PD) patients. In a cross-sectional study of 252 prevalent Chinese PD patients in Hong Kong, the average serum phosphorus level was 1.68 ± 0.48 mmol/L [2]. More importantly, serum phosphorus levels were greater than 1.8 mmol/L in 44% of anuric patients versus 29% of patients with residual renal function. In this study, multiple regression analysis showed that residual glomerular filtration, despite an average of less than 2 mL/min/1.73m², was independently associated with phosphorus control in PD patients [2]. It could be argued that Hong Kong Chinese consume a relatively westernized diet with high phosphorus content.

In this issue of the Hong Kong Journal of Nephrology, Wang et al [3] provide additional insight into this problem. This group from Beijing performed a careful metabolic balance study with a 3-day dietary record on the intake and 24-hour dialysate and urine collection on the dialysis removal of phosphate in 41 stable PD patients. Over 50% of patients had serum phosphate levels above 1.8 mmol/L. Given the prolonged duration on dialysis prior to the study, these patients probably had minimal residual renal function. Not unexpectedly, serum phosphate levels correlated closely with dietary protein intake. However, the average dietary protein intake was 0.8 g/kg/day, which is below the level recommended by the Kidney and Dialysis Outcome Quality Initiative [4] and that in the previously mentioned study from Hong Kong [2], while the dietary phosphate intake was around 600 mg/day. In other words, a low protein Chinese diet does not equal phosphate restriction. More interestingly, over 60% of the hyperphosphatemic patients received calcium carbonate as a phosphate binder in this study [3]. Positive calcium balance was demonstrated in many of the patients, and almost 20% had a certain degree of hypercalcemia together with hyperphosphatemia—an ominous combination.

Serum phosphate level is strongly associated with the mortality of hemodialysis patients and, probably, PD patients. The mechanisms by which hyperphosphatemia contributes to increased mortality in dialysis patients are not fully understood, but increased cardiovascular calcification is the mechanism that is most commonly suggested [5]. Cardiac calcification has been shown in more than 60% of dialysis patients. It occurs in the myocardium, conduction tissues, cardiac valves, and coronary arteries, and is associated with increased calcium phosphorus product. Patients with serum phosphorus levels greater than 2.1 mmol/L had a 52% greater relative risk for mortality from coronary artery disease and a 26% greater relative risk for sudden death compared with those who had serum phosphorus levels of 0.8–2.1 mmol/L. Every 0.8 mmolF/L² increase in calcium phosphorus product was associated with an 11% increase in relative risk for mortality [5]. Another recent study showed that cardiac valve calcification predicted all-cause and cardiovascular mortality in PD patients [6].

Given the important link between hyperphosphatemia, cardiovascular calcification, and the excess in cardiovascular mortality and morbidity, better measures are needed for the control of hyperphosphate mia in dialysis patients. Sevelamer, vitamin D analogs and calcimimetics are among the new agents in the armamentarium of nephrologists in the battle against hyperphosphatemia [7]. They are generally safe and effective in suppressing parathyroid hormone and reducing serum phosphate levels, especially in patients...
who have been resistant to conventional medical treatment. Nevertheless, what we need is long-term study on the efficacy of these agents in reducing cardiovascular diseases in dialysis patients.

References


