

# Hyperphosphatemia is not significantly associated with increased all-cause mortality in Korean hemodialysis patients

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## To the Editor:

We read the paper entitled “Association of serum mineral parameters with mortality in hemodialysis patients: Data from the Korean end-stage renal disease registry” by Kim et al [1] with great interest. Using data from the nationwide Korean Society of Nephrology ESRD Registry, the authors revealed that high serum calcium, low phosphorus, and both high and low intact parathyroid hormone levels were associated with increased all-cause mortality. Notably, however, hyperphosphatemia was not significantly associated with increased all-cause mortality in Korean hemodialysis patients. This is in sharp contrast to studies from other countries, including Japan, which have consistently shown that patients with hyperphosphatemia are at increased risk of death.

We agree in part with the authors’ speculation that patients with hyperphosphatemia are more likely to have better nutritional status, thereby negating the detrimental impact of high phosphate on survival. On the other hand, we believe that other potential factors, such as per-

formance status [2] and magnesium status [3], could also explain their unexpected findings.

First, functional impairment could have attenuated the association between hyperphosphatemia and increased risk of death. A nationwide cohort study using data from the Japanese Society for Dialysis Therapy Registry found that poor performance status attenuated the effect of hyperphosphatemia on mortality in Japanese dialysis patients [2]. Although detailed information about performance status was not reported in the study by Kim et al [1], functional impairment and frailty are commonly observed in dialysis patients, especially in elderly dialysis patients.

Second, serum magnesium level may have affected the prognostic impact of hyperphosphatemia. Another study using data from the Japanese Society for Dialysis Therapy Registry reported that the mortality risk of patients with hyperphosphatemia was significantly attenuated with increasing serum magnesium level [3]. Notably, the average (standard deviation) serum magnesium concentration in hemodialysis patients in Korea was reported to be 3.43 (0.46) mg/dL [4], which is much higher than that reported from other countries [5]. Taken together, these results indicate that high serum magnesium concentration in Korean hemodialysis patients may contribute to lowering the mortality risk associated with hyperphosphatemia.

Also noteworthy is that dietary sources of phosphorus in Korean hemodialysis patients may differ from those of other countries. Nonetheless, we believe the study by Kim et al [1] provides insight that could help reduce the burden of hyperphosphatemia, a common problem among dialysis populations throughout the world.

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## Conflicts of interest

All authors have no conflicts of interest to declare.

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## The authors' reply

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We appreciate the interest of Dr. Wakasugi and Dr. Sakaguchi in our recent publication about the association of serum mineral parameters with mortality in hemodialysis patients, an analysis of the data from the nationwide Korean Society of Nephrology (KSN) End-Stage Renal Disease (ESRD) Registry. As they have commented, our results have some discrepancy with other studies on the association between serum phosphorus level and mortality, including one from Japanese Renal Data Registry data [1], in that hyperphosphatemia was not significantly associated with increased mortality. Although limited, data from one study showed results similar to ours. In

a Portuguese observational cohort study, patients with hyperphosphatemia did not show difference in mortality (hazard ratio [HR], 1.00; 95% confidence interval [CI], 0.74–1.35), whereas patients with hypophosphatemia showed increased mortality (HR, 1.29; 95% CI, 1.07–1.55) [2].

We speculated several explanations for our results. Favorable nutritional status may have attenuated the hazardous effect of hyperphosphatemia. In our *post-hoc* analysis of the KSN ESRD Registry data, increased risk of mortality in the high phosphorus group was exhibited only if combined with concurrent low serum albumin level, suggesting that the nutritional status attenuated the harmful effect of high phosphorus level (Table 1). Nutritional indices other than serum albumin could provide further information. However, we were unable to examine the relevance of normalized protein nitrogen appearance (nPNA) in the relationship between phosphorus

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